TYPE A BEHAVIOUR AND THE PERCEPTION AND REPORT OF VISCERAL SENSATIONS

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I declare that this thesis reports my original work; that no part has been previously accepted or presented for the award of any degree or diploma from any university; and that, to the best of my knowledge, no material previously published or written by any other person is included, except where due acknowledgement is given.

Fernando Hector Roldan

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TABLE OF CONTENTS | Page

ADDENDUM

ABSTRACT

The Type A behaviour pattern has been found to be associated with an increased risk of coronary heart disease. The mechanisms mediating this association are not clear, although the idea that Type A individuals' cardiovascular and catecholaminergic reactivity to challenges and stressors contributes to coronary heart disease has played a prominent role in the literature.

Recent investigations have suggested that an alternative explanation for the association between Type A behaviour and coronary heart disease may arise from the observation that Type A individuals report fewer and less intense symptoms.

This pattern of symptom report may put the individual at risk because of its implications for prompt and efficient implementation of self-regulatory and remedial actions.

The studies reported in this thesis sought to elucidate the processes underlying Type A individuals' symptom report pattern and the implications of this for self-regulatory behaviour.

Previous investigations of between-types differences in symptom report have involved undergraduate university students. However, the association between Type A behaviour and coronary heart disease has been most consistently demonstrated for employed adult males.

Study 1 aimed to replicate previous findings, in a population of employed adult males. This study also investigated the merits of two alternative explanations of Type A individuals' symptom under-report. One of these is that Type A individuals might suppress or deny symptoms as a strategy to ensure high levels of performance. The alternative hypothesis which was considered conceptualizes this phenomenon as the result of attention focus on challenging or threatening aspects of the environment at the expense of task peripheral physical sensations.

Study 1 revealed that despite exhibiting greater cardiovascular arousal in response to an ego challenging cognitive task, Type A individuals reported fewer and less intense physical and emotional symptoms. However, no support was found for the hypothesis that this represented a strategy to protect ongoing performance.

Only limited support was found for the hypothesis that Type A subjects' symptom under-report might have been mediated by attention focus on task-relevant aspects of the environment at the expense of task-peripheral stimuli. It was found that Type A subjects' symptom under-report was not significantly associated with the superior processing of task-relevant stimuli or inferior processing of task-peripheral stimuli. However, there were aspects of the data from Study 1 which were consistent with an attention focus explanation. For example, in what could be described as an elevated viscerosomatic threshold, Type A individuals required greater elevations in heart rate than Type Bs before reporting heart racing. Furthermore, when they did report this symptom, they rated it as having a similar intensity as that reported by their less aroused Type B counterparts.

Studies 2 and 3 investigated the possibility that Type A individuals' symptom under-report was related to a dispositional rather than situationally elicited characteristic. It was hypothesized that between-type differences in visceral perception ability or the tendency to habitually attend to visceral stimuli could explain Type A individuals symptom under-report.

However, these studies revealed that there was no association between Type A behaviour and dispositional private self and body consciousness and that Type A individuals were as competent as Type Bs in dispositional visceral perceptiveness.

Given the failure to account for Type A individuals' symptom under-report in terms of dispositional variables or a situationally elicited denial or suppression strategy, Studies 4 and 5 elaborated upon the attention focus explanation which had earlier been given only limited support by the findings of Study 1.

Studies 4 and 5 investigated Type A individuals' ability to process bodily changes in conditions where attention focus was manipulated. The results of these studies indicated that during exposure to complex external stimuli which tapped Type A individuals' concern with mastering an ego challenge or threat, these individuals exhibited restricted processing of physical sensations. No between-types differences in the detection and report of these sensations were observed in the absence of the situational characteristics described above.

Study 6 investigated the possible implications which restricted processing of physical sensations may have for the implementation of self-regulatory action. It was found that when exposed to complex and ego challenging external stimuli, Type A individuals delay the termination of an exertion-inducing activity well beyond the level which they and others would normally tolerate.

It was concluded that due to their concern with ego challenging or threatening aspects of the environment, Type A individuals may allocate a greater proportion of attention capacity than Type Bs to those aspects of the environment which are perceived as relevant to successfully mastering these challenges or threats. As a consequence of this attention focus, Type A individuals might be left with less spare capacity than Type Bs to process task peripheral physical sensations. This state of affairs appears to manifest itself in an elevated viscerosomatic threshold and an inability to use symptoms as a sign to alter behaviour or otherwise take remedial action.

The practical and empirical contributions of this research, its relevance to the existing literature, the implications of its findings for understanding the association between Type A behaviour and coronary heart disease, and the identification of intervention priorities are discussed.

CHAPTER 1

1.1 The Type A behaviour pattern: The concept and its history

Epidemiological research has identified a number of factors which have been generally accepted by the medical community as posing risks for coronary heart disease (CHD). These factors include elevations in blood pressure (BP) and serum cholesterol, frequency of cigarette smoking, dietary intake of animal fat, a family history of CHD, and a sedentary life style.

Despite their wide acceptance, the traditional risk factors mentioned above have been shown to be incapable of fully explaining the incidence of CHD (see e.g., Rosenman, 1974). This observation prompted different investigators to search for alternative risk factors. Of these, behavioural and emotional characteristics have been the subject of most attention.

Informal observations regarding the possible role of behavioural and emotional factors in the etiology of CHD were made as early as the beginning of this century. Osler (1910), for example, made presumptive diagnoses of angina based on the mannerisms and appearance of his patients. Osler (1910) observed that:

> "It is not the delicate neurotic person who is prone to angina, but the robust, the vigorous in mind and body, the keen and ambitious man, the indicator of whose engines is always set 'full speed ahead'." (p. 839).

Although Osler's ideas were later taken up by others (e.g., Menninger and Menninger, 1936; Dunbar, 1943; Kemple, 1945), it was not until the 1950's that his early observations of a link between behavioural and emotional factors and CHD were investigated in a systematic manner.

Two American cardiologists, Friedman and Rosenman (see Friedman and Rosenman, 1959; Rosenman and Friedman, 1959) developed a conceptual definition of a group of behaviours which they considered coronary-prone and initiated the first attempt to classify individuals into behaviour types and determine whether this classification was predictive of CHD.

Friedman and Rosenman observed that the literature failed to show a linear relationship between coronary morbidity, serum lipids, and dietary fat intake (e.g., Gofman et al., 1956; Hatch et al., 1966; Paul et al., 1963; Morris, Marr, Heady, Mills, and Pilkington, 1963; Shaper, 1962; Yudkin, 1957) and that the rise and fall in the incidence of CHD-related death in the United States during this century, could not be explained by changes in the traditional risk factors, genetic considerations, or changes to diagnostic procedures or to the age structure of the population (see Rosenman, 1974).

Rosenman (1974) reports that their search for alternative risk factors was given direction by findings indicating that differences in the incidence of CHD between white American men and women could not be explained in terms of diet (Friedman and Rosenman, 1957) nor in terms of hormonal differences between the sexes (Keil and McVay, 1956; Keys, 1954). Based on these findings, they tentatively hypothesized that the lower incidence of CHD enjoyed by white American females relative to their male counterparts may have been due to the former's relative absence from the work environment and consequent protection from work-related stress (see Rosenman, 1974). This hypothesis appeared to be supported by the finding that occupational responsibility could explain the incidence of CHD equally as well as dietary fat intake (e.g., Bronte-Stewart, Keyes, and Brock, 1955).

Friedman and Rosenman found further support for the notion that emotional factors, and in particular work-related stress, may play an important role in the development of CHD in a 5 month study of tax accountants (see Friedman, Rosenman, and Carroll, 1958). This study revealed marked elevations in serum cholesterol levels as the tax deadline neared. Furthermore, these elevations in serum cholesterol were found to be independent of diet, weight, and exercise patterns. This finding indicated that cholesterol level, a known contributor to CHD, could fluctuate as a function of work-related stress.

The study described above led Friedman and Rosenman to re-examine their CHD patients, in search of common behavioural and emotional characteristics. This exercise revealed that their patients (who were mostly males) tended to exhibit a certain pattern of behaviours, which included: (a) an extraordinary need for recognition and advancement; (b) an habitual intense drive to accomplish usually poorly defined goals; (c) a strong desire to compete; (d) an obsessive involvement with work and striving to meet deadlines; (e) incessant time-urgent behaviour; (f) extreme mental and physical alertness; (g) persistent vigorous acceleration of physical or mental activity; and (h) free-floating hostility that was easily aroused by delay or perceived incompetence in others (see Friedman and Rosenman, 1960, 1974; Rosenman, 1986). Friedman and Rosenman referred to these behavioural and emotional characteristics as "coronary prone" and for descriptive purposes coined the term "Type A behaviour pattern" (TABP).

Subsequently, Friedman and Rosenman carried out two prevalence studies, in which lay persons were asked to select from their acquaintances individuals exhibiting coronary prone behavioural and emotional characteristics and individuals relatively lacking in those characteristics (see Friedman and Rosenman, 1959; Rosenman and Friedman, 1961). These studies revealed that both male and female subjects high on the above mentioned characteristics exhibited significantly higher levels of serum cholesterol and signs of CHD than individuals rated as lacking those characteristics.

On the basis of the findings described above, Friedman and Rosenman embarked in a large prospective investigation (The Western Collaborative Group Study - WCGS - Rosenman et al., 1964) designed to evaluate the association between CHD incidence and the emotional and behavioural attributes which they suspected of being coronary prone. Before undertaking this study, however, the Type A coronary-prone behavioural and emotional attributes were carefully defined and a standardized method for their assessment was constructed. This method of assessment took the form of a Structured Interview (SI - Rosenman et al., 1964) designed to elicit Type A behaviours. (The SI method for assessment of Type A behaviour is discussed in detail later in this chapter - see Section 1.2.1).

Although the evidence for the association between the TABP and CHD is discussed in greater detail in Chapter 2, it should be noted here that SI ratings of subjects by interviewers trained in the WCGS were found to be significantly associated with the incidence of CHD at an 8.5 year follow-up (Rosenman et al., 1975). This risk persisted when statistical controls were introduced to partial out the effects of traditional risk factors (Rosenman et al., 1975). Similarly important was the finding that the risk associated with the Type A constellation of behaviours was equal to that conferred by any other risk factors. Therefore, the findings of the WCGS offered the first strong prospective evidence that the constellation of behavioural characteristics earlier described by Friedman and Rosenman was an independent risk factor for CHD.

The findings from the WCGS motivated a great deal of clinical observation and experimental research on the components of the TABP and their manifestation. As a consequence of this, the definition of the TABP has been enriched by the addition of new attributes. Furthermore, this wealth of research has served to fine tune various aspects of the original formulation of the construct. Research relating to the characteristic behavioural components of the TABP is discussed in greater detail later in this chapter (see Section 1.3). At this point it is worth noting, however, that pre-classification of subjects as Type A or Type B (i.e., non Type A) has been shown to successfully predict demonstrable behaviours indicative of the characteristics hypothesized to be part of the coronary prone behaviour pattern by Friedman and Rosenman.

It should also be noted here, that the TABP does not represent a discrete typology, but it is thought to be a continuum of behaviours. Descriptions of Type A and Type B individuals represent extremes of this bipolar continuum, which is thought to be normally distributed in the United States population (see Rosenman et al., 1964).

An important aspect of the conceptualization of the TABP is that this construct is not considered to be a set of personality characteristics or to be the same as stress or distress, but rather a well established behavioural and psychological response set that is elicited from susceptible individuals on a consistent basis by appropriately challenging stimuli in the environment (e.g., Burke and Weir, 1980; Friedman and Rosenman, 1971; 1974; Jenkins, 1976; Glass, 1977; Matthews, 1982). In other words, the extent to which Type A individuals manifest the TABP may be at least partially dependent upon specific contextual characteristics of the environment. As reported later in this thesis (see Sections 1.3 and 1.5, and 2.2), psychosocial and psychophysiological studies have tended to provide support for the situation-specific nature of Type A behaviour.

Before considering the evidence for the attributes which are said to make up the TABP and the evidence for the proposed association between the TABP and CHD, it is necessary to describe the different methods for the assessment of the TABP, which have been employed in gathering this evidence. This is necessary because different assessment methods may not measure the same aspects of the TABP. Thus, the interpretation of data requires that reference be made to the method of TABP assessment employed in each study.

1.2 Assessment of the Type A behaviour pattern

As the medical and psychological importance of the Type A construct became apparent, the need to carefully delineate diagnostic criteria and to standardize assessment procedures became paramount. It was for this reason that Friedman and Rosenman developed the SI (Rosenman et al., 1964). Later, in the search for more economic measures of the TABP, various self-report instruments were designed with the aim of mimicking SI classification. The following sections describe both interview and self-report measures of Type A behaviour.

Given that an important aspect of the validation of measures of the TABP is the evaluation of their ability to predict CHD, the following sections make passing reference to the evidence for the association between TABP and CHD. A more detailed discussion of this evidence is presented in Chapter 2.

1.2.1 The Structured Interview for assessing Type A behaviour

The SI was first used in the WCGS (Rosenman et al., 1964). Except for some changes to its scoring system and a reduction in the number of questions, it has remained unchanged since then. The SI contains some questions that are of a general nature, asking subjects about their age and occupation, but it also contains questions regarding the subjects' self-perception of their drive levels (e.g., 'Do you think you drive harder to accomplish things than most of your associates?' - see Rosenman, 1978), as well as questions regarding work involvement (e.g., 'Do you take work home with you? How often?' - see Rosenman, 1978). The interviewer also asks subjects about their characteristic way of responding to competitive situations (e.g., 'When you play games with people your own age, do you play for the fun of it, or are you in there to win?'- see Rosenman, 1978) and questions concerning the subject's perception of competition in the environment (e.g., 'Is there any competition in your job?' - see Rosenman, 1978).

The SI also includes questions about subjects' reactions to situations eliciting hostility (e.g., 'When you are in your automobile, and there is a car in your lane going far too slowly for you, what do you do about it? Would you mutter and complain to yourself? Would anyone riding with you know that you were annoyed?' - see Rosenman, 1978), impatience (e.g., 'How do you feel about waiting in lines: Bank lines, or Supermarket lines? Post office lines?' - see Rosenman, 1978), and time urgency (e.g., 'Do you have the feeling that time is passing too rapidly for you to accomplish all of the things you'd like to get done in one day?' - see Rosenman, 1978).

Other items of the SI represent a direct behavioural test. For example, the interviewer may deliberately stall while asking a question, with the aim of eliciting Type A behaviours from subjects (e.g., 'Most people who work have to get up fairly early in the morning - in your particular case, uh-what-time-uh-do-you-uh, ordinarily uh-uh-to-uh-uh-get-up?' - see Rosenman, 1978). In this type of item, Type A subjects are usually observed to interrupt or hurry the interviewer. The SI also includes questions regarding others' perceptions of the subject's behaviours (e.g., 'How would your wife (husband) describe you - as hard-driving and ambitious or as relaxed and easy-going?' - see Rosenman, 1978).

Although the interview was designed to be delivered in a standardized manner, interviewers are required to ask questions in a provocative style and at times to challenge the subject's responses to a question. The SI protocol provides specific instructions on the standardized wording of each question, the probing for further information and the verbal style to be used in asking each question (see Rosenman, 1978). Rosenman (1978) suggests, however, that the accurate assessment of Type A behaviour may at times depend on finding topics for discussion in which the individual may be interested. Rosenman argues that this encourages the subject to get involved in the discussion and allow inner feelings and concomitant behavioural mannerisms to be expressed.

Rosenman (1978) suspects that Type A individuals may not be entirely aware of their Type A behaviours and may tend to provide answers which are socially desirable. Thus, the observation of behavioural manifestations of the TABP may be particularly important in the accurate classification of these individuals. In the SI, behaviour type classification is not only based on subjects' self-reports of Type A behaviour, but also on subjective ratings of subjects' general appearance (e.g., signs of nervous tension, alertness), attitude (e.g., signs of hostile or challenging attitude), speech characteristics (e.g., loudness, interruptions, explosive modulation), and facial and postural mannerisms (e.g., movement of hands and feet, fist clenching, clenched jaw, motor pace).

The SI is subjectively rated on a global basis; however, both speech stylistics and behavioural mannerisms are usually given greater weight than answer content in arriving at a decision about subject classification (see Dembroski, MacDougall, Shield, Pettito, and Lushene, 1978; Matthews, Krantz, Dembroski, and MacDougall, 1982; Scherwitz, Berton, and Leventhal, 1977; Scherwitz, Graham, Grandits, and Billings, 1987; Schucker and Jacobs, 1977). More detailed information on the item content, interview procedure, and scoring of the SI can be found in Rosenman (1978) and Chesney, Eagleston, and Rosenman (1980, 1981).

Acceptable levels of inter-rater reliability have been found for the SI. Jenkins, Rosenman and Friedman (1968) report that in the WCGS, the two interviewers were found to agree in their classification of subjects in 84% of cases and Caffrey (1968) has reported an inter-rater agreement of 75-77%. The most impressive levels of inter-rater agreement were obtained in the Multiple Risk Factor Intervention Trial (MRFIT - The Multiple Risk Factor Intervention Trial Group, 1979) in which two independent raters re-assessed 2,198 taped interviews which had been previously assessed by five field interviewers. This exercise revealed an agreement of 81 to 85% between the two independent raters and the five interviewers (see Rosenman, 1978). Rosenman, who re-assessed 285 of the MRFIT interviews, found that his ratings coincided with those of the five field independent raters in 86% of the cases and with those of the two independent MRFIT raters 90% of the time (see Rosenman, 1978). These levels of inter-rater agreement are comparable to those obtained for medical diagnosis made from electrocardiograms and radiographs (see Jenkins et al., 1968).

Acceptable levels of test-retest reliability have also been found for the SI. Jenkins et al. (1968), for example, found that at 12 to 20 months follow-up, 80% of WCGS subjects were placed in the same category to which they had been originally allocated by WCGS interviewers. Rosenman et al. (1964) report an identical level of test-retest reliability for a similar sample of WCGS subjects, at a 2 year follow-up. In another study, Keith, Lown, and Stare (1965) obtained 74% agreement with original classification, when readministering the SI to subjects at a 3 to 18 months follow-up. Given that the TABP is conceptualized as a dynamic behaviour pattern which is expected to show fluctuations over time (see e.g., Matteson and Ivancevich, 1980), the levels of test-retest reliability cited above appear to be acceptable.

Since the TABP was conceptualized as a pattern of coronary prone behaviours, the validity of the SI can be best assessed by examining its association with CHD incidence and evidence of pathological processes involved in the development of CHD. In this regard, it should be noted that SI ratings have been found to be significantly associated with CHD, in both retrospective and prospective studies (e.g., Caffrey, 1968, 1969, 1970; Rosenman et al., 1975; Rosenman et al., 1970; Rosenman et al., 1966; Rosenman et al., 1964; Wardell and Behnson, 1973).

Ratings on the SI have also been shown to be significantly related to coronary atherosclerosis, the underlying disease process of CHD (e.g., Blumenthal et al., 1975; Blumenthal, Williams, Kong, Schanberg, and Thompson, 1978; Frank, Heller, Kornfeld, Sporn, and Weiss, 1978; Keegan, Sinha, Merriman, and Shiplay, 1979;

Krantz, Sanmarco, Selvester, and Matthews, 1979; Jenkins, Zyzanski, and Rosenman, 1976; Orth-Gomer and Ahlblom, 1980; Perosio, Capris, Moores, Iraola, and Rossi, 1977; Williams et al., 1980; Williams et al., 1986).

Several researchers have concluded that using utility of prediction of CHD as the most important criterion of validity, the SI appears to be the measure of choice for the assessment of Type A behaviour (see Byrne, Rosenman, Schiller, and Chesney, 1985; Chesney et al., 1980; Surwit, Williams, and Shapiro, 1982; Jenkins, 1976, 1978; Matthews and Haynes, 1986; Rosenman, 1978).

The reasons underlying the apparent superiority of the SI over self-report measures in predicting risk for CHD are not entirely clear. However, one possible explanation is that the SI provides the interviewer with the opportunity to actually elicit evidence of the subject's characteristic way of responding to relevant environmental stressors. This evidence is simply not available through self-report measures of Type A behaviour (see Byrne et al., 1985; Matthews and Haynes, 1986; Rosenman, 1978). Furthermore, given Type A individuals' hypothesized unawareness about personal characteristics (see Rosenman, 1978), it is possible that the apparent superiority of the SI may lie in its reliance on speech stylistic and behavioural manifestations of Type A behaviour, rather than interview content (see Dembroski et al., 1978; Matthews et al., 1982; Scherwitz et al., 1977; Scherwitz et al., 1987; Schucker and Jacobs, 1977). Observations regarding the predictive value of Type A behavioural manifestations have promoted the practice of video taping of the SI (see Friedman et al., 1982) so as to more carefully evaluate subjects' behaviour.

Despite the demonstrated value of SI ratings in predicting CHD, Matthews (1982) observes that the validation of SI-assessed Type A behaviour is incomplete. Matthews (1982) explains that relatively little is known about the characteristics of interview assessed Type A and Type B individuals. She attributes this to the tendency by researchers to use more convenient self-report measures of Type A behaviour when classifying subjects taking part in experiments designed to elicit the TABP. The use of the SI as a measure of Type A behaviour in experimental research has not been as widespread as its demonstrated usefulness might have suggested (see Price, 1982; Herbertt, 1983) because of the expense in time and money involved in the training of interviewers in the administration of the SI, particularly for researchers outside the United States (see Herbertt, 1983).

1.2.2 The Jenkins Activity Survey for Health Prediction as a measure of Type A behaviour

The cost associated with use of the SI has motivated the development of alternative measures of Type A behaviour. The more widely used of these alternative measures has been the Jenkins Activity Survey for Health Prediction (JAS). The JAS is a self-report measure constructed from multiple choice versions of SI items and from other items thought by the authors to reflect Type A characteristics (see Jenkins, Zyzanski, and Rosenman, 1979).

Development of the 1964, 1965, and 1966 versions of the JAS was performed through cross-validation with the SI (see Jenkins, Rosenman, and Zyzanski, 1965; Jenkins et al., 1979; Rosenman et al., 1964). Development of the 1969, 1972 (Form B), and 1979 (Form C) versions, however, were performed through cross-validation with earlier versions of the JAS (see Jenkins et al., 1979).

The studies reported in this thesis employed the latest version of the JAS, that is Form C (Jenkins et al., 1979 - see Appendix A.1) to measure Type A behaviour. This version of the JAS consists of 52 items, 21 of which comprise the Type A subscale. The JAS also consists of the Hard-Driving and Competitiveness, Speed and Impatience, and Job Involvement subscales.

The person scoring high in the Hard-Driving and Competitiveness subscale is said to perceive himself or herself as being generally more serious, responsible and conscientious about work and life in general than other people. This subscale also measures the perception of oneself as a highly competitive individual and as engaging in behaviours such as 'trying to win when playing with young children' (see Jenkins et al., 1979).

The Speed and Impatience subscale measures self-reported time urgency as reflected in every day activities such as eating rapidly, becoming impatient with the conversations of others and trying to hurry others. Individuals scoring high on this factor are also said to become easily irritated and to have a strong temper (see Jenkins et al., 1979).

The Job Involvement subscale measures the individual's strong sense of commitment to occupational activities by working overtime and trying to meet the deadlines of high-pressure jobs (see Jenkins et al., 1979). According to Jenkins et al.

(1979), individuals scoring high on this subscale also prefer promotions over pay rises but they are likely to have obtained both in recent years.

Jenkins et al. (1979) explain that while the Speed and Impatience subscale evaluates the style of behaviour that characterizes the TABP, the Job Involvement subscale describes the work environment that may promote the emergence of Type A behaviours. These environments appear to reward and encourage aggressively competitive behaviour, working long hours without heeding the warning signals of the organism and trying to achieve more and more in less and less time. On the other hand, the Hard-Driving and Competitiveness subscale is said to evaluate the individual's perception of the self, and the moral and social values that govern both self perception and behaviour (see Jenkins et al., 1979). Values associated with the protestant work ethic have been mentioned in relation to Type As' hard-driving and striving for success and their perception of themselves as achieving goals through their adherence to values such as hard work, efficiency and an ability to meet challenges and work demands (see Margolis, McLeroy, Runyan, and Kaplan, 1983; Price, 1982).

Jenkins et al. (1979) report that the normative data for Form C are based on the 1969 JAS scores of 2,588 WCGS male participants. The range of raw scores from this population proved to approximate a normal distribution in which, for all four subscales, the mean score was transformed to zero, with a standard deviation of ten. The transformed scores are usually referred to as 'standard scores'. Within these arrangements, a positive standard score in the Type A scale is taken to indicate the Type A direction, while a negative standard score is taken to indicate the Type B direction. Similarly, on the other three subscales, a positive standard score is interpreted as indicating the behavioural characteristics denoted by the names of the subscales, while a negative standard score is interpreted as denoting the relative lack of characteristics measured by the particular subscale. It should be noted that, given that the TABP is conceptualized as a continuum of behavioural characteristics, a standard score of zero does not represent an absence of Type A characteristics, but rather the mean of the WCGS population on which the JAS was standardized.

The item composition of the four JAS subscales and the scoring algorithms are exactly the same for the 1969, 1972 (Form B), and 1979 (Form C) versions (Jenkins et al., 1979). Therefore, data concerning the reliability and validity of the 1969 and 1972 (Form B) versions can be taken to apply to the 1979 (Form C) version.

Jenkins et al. (1979) report internal reliability coefficients for the four JAS Form C subscales ranging from .73 to .85 . Specifically, these authors report internal consistency coefficients of .83 and .85 for the Type A scale of the JAS. Internal consistency coefficients for the other three subscales ranged from .73 to .83. Jenkins and Zyzanski (1982) argue that internal reliability coefficients of more than .80 for the Type A scale are quite high, considering that the TABP is not a unidimensional psychological construct, but rather a multidimensional one.

Test-retest reliability coefficients for different versions of the JAS Type A scale, ranging from .60 to .70 for intervals of one to four years and from .65 to .82 for intervals of four to six months, have been reported (Jenkins et al., 1979). Jenkins et al. (1979) argue that these reliability coefficients are acceptable and that they demonstrate the stability of Type A characteristics as measured by the JAS.

The validity of the JAS as a measure of Type A behaviour with implications for CHD has been evaluated through the investigation of concordance rates between JAS and SI behaviour type classification and in studies directly investigating the association between JAS behaviour type classification and CHD.

The final cross-validations between the JAS and the SI in the WCGS took place with the 1965 and 1966 versions of the JAS in samples of middle-aged, employed men (see Jenkins et al., 1979). These analyses revealed a 73% and 71% concordance rate between SI and JAS behaviour type classification (see Jenkins et al., 1979). The degree of agreement between these two measures improved for those exhibiting extreme Type A or Type B characteristics. For example, in the cross-validation of the 1965 version of the JAS, when only Type A and Type B subjects who were more than one standard deviation away from the mean were included in the analysis, agreement rose to almost 90%, (see Jenkins, Zyzanski, and Rosenman, 1971).

Dimsdale, Hackett, Catanzano, and White (1979) report an overall agreement of 72% between the JAS - Form B and the SI in a sample of 103 middle-aged males awaiting coronary angiography. This agreement rose to 84% when individuals scoring less than one half of one standard deviation away from the WCGS standardization population mean were excluded from the analysis. Matthews et al. (1982) report an overall agreement between the SI and the JAS - Form B of 67% in a sample of 163 employed men. However, contrary to previous studies, in which cases falling in the middle of the Type A subscale distribution (on either side of the mean) were the most likely to be classified differently by the JAS and the SI, Matthews et al. (1982) found relatively high agreement for all of the Type A half of the distribution, including scores close to the mean (i.e., 0 to 4.9 = 80.0%, 5.0 to 9.9 = 84.2%, 10.0 and above = 87.5%). Surprisingly, Matthews et al. (1982) also found relatively low agreement levels for all of the Type B half of the distribution, including extreme scorers (i.e., 0.1 to 4.9 = 47.4%, -5.5 to -9.9 = 52.9%, -10.0 and below = 51.7%).

Contrary to Matthews et al.'s (1982) findings, Byrne at al. (1985) obtained higher levels of agreement between the SI and the JAS for Type B subjects than for Type A subjects in a sample of 587 employed Australian males. These researchers found a concordance rate for the Type A1 (i.e., 'extreme' Type A) classification of 31% and a concordance rate for the Type A2 classification of 36%. On the other hand, the concordance rate for the Type B classification was of 73%. It is possible that particular characteristics of Byrne et al.'s (1985) population may have militated against higher agreement rates. Specifically, Byrne et al.'s subject sample included approximately 25% rural dwellers, whose manifestation of Type A behaviour may be somewhat different to that of their city counterparts (see Cohen, 1978; Cohen, Matthews, and Waldron, 1978).

Cross-validation of the JAS with the SI has also been carried out in non English speaking populations. Kittel et al. (1978), for example, using French and Flemish translations of the JAS (Form B) and the SI, found 70% overall agreement in a Belgian sample of 726 middle-aged men. A similar level of agreement was reported in a Dutch population (see Appels, Jenkins, and Rosenman, 1982).

Generally speaking, overall agreement rates between the JAS and the SI have been, at best, moderately acceptable. This moderate level of overall agreement between the two measures has increasingly called into question the assumption that the JAS replicates or mimics SI-based behaviour type classification. In particular, the studies reviewed above suggest a lack of confidence in the discriminating ability of the JAS in those cases where the individual is in the border zone between Type A and Type B classification. In order to ensure, as far as possible, the accurate classification of subjects, the studies reported in this thesis (requiring dichotomous classification of subjects as Type A and Type B) only included extreme scorers in the Type A subscale of the JAS (i.e., those scoring one half of one standard deviation above or below the mean of volunteers). This aspect of subject selection is discussed in greater detail in Chapter 4.

The relatively moderate rate of overall agreement found between JAS and SI behaviour type classification, has led some researchers (e.g., Byrne et al., 1985; Matteson and Ivancevich, 1980; Matthews, 1982; Matthews et al., 1982; Siegel, 1984) to suggest that the JAS and the SI may not measure the same group of coronary prone behaviours or that the SI may yield data which are not available through self-report measures such as the JAS. Matthews et al. (1982), for example, note that while sources of common variance between the two instruments include self-reported pressured drive and hostility, energy levels, and competitiveness, the source of unique variance for the SI is subjects' speech characteristics. Matthews et al. (1982) also indicate that the JAS has its own source of unique variance (relevant to the TABP concept), namely self-reported time pressure.

The validity of JAS behaviour type classification can also be evaluated in terms of its ability to predict CHD. Retrospective research has provided support for the association between Type A behaviour, as measured by the JAS, and CHD. This has included evidence that myocardial infarction (MI) patients score higher than healthy controls (e.g., Hiland, 1977; Jenkins, Zyzanski, Rosenman, and Cleveland, 1971; Kornitzer, Kittel, De Backer, and Dramaix, 1981; Zyzanski, Wrzesniewski, and Jenkins, 1979; Stokols, 1973) and non CHD patients (e.g., Cohen, 1974; Glass, 1977; Kenigsberg, Zyzanski, Jenkins, Wardell, and Licciardello, 1974) in the Type A subscale of the JAS. Furthermore, a number of studies has indicated a relationship between Type A behaviour as measured by the JAS and risk for recurrent MI in persons already suffering from CHD (e.g., Jenkins et al., 1976; Jenkins, Zyzanski, Rosenman, and Cleveland, 1971). In addition, prospective studies have indicated that scores in the Type A subscale of the JAS are predictive of subsequent development of CHD (e.g., Jenkins, Rosenman, and Zyzanski, 1974).

Support for the validity of the JAS as a measure of coronary-prone behaviour has also been provided by the finding that scores in the four JAS subscales are significantly and positively associated with the extent of coronary atherosclerosis (e.g., Zyzanski, Jenkins, Ryan, Flessas, and Everist, 1976).

In summary then, although the JAS was developed to mimic SI ratings, concordance rates between the two measures have been found to reach only moderate levels. As noted earlier, the JAS may not capture some aspects of the TABP measured by the SI, due to its complete reliance on self-report. Despite the fact that JAS classification may not reliably mimic SI classification, there is evidence to suggest that Type A behaviour as measured by the JAS may nonetheless be coronary prone. However, as discussed in Chapter 2, this evidence has been generally less impressive than that for the SI.

Compared to the SI, the JAS is relatively inexpensive to administer and score, and has been the most widely used measure of Type A behaviour. These considerations, together with the observation that (relative to other self-report measures of Type A behaviour), the JAS appears to have acceptable levels of reliability and validity, prompted the present author to opt for the use of the JAS (Form C) for behaviour type classification in the studies reported in this thesis.

Finally, it should be noted that the JAS contains 15 items that are only applicable to those persons engaged in full-time work or who are otherwise steadily employed. These items relate to pressures at work, deadlines, promotions and the option to take vacations. Thus, they are inappropriate for use with students, retired individuals, and housewives. Jenkins et al. (1979) point out that although there is no evidence to suggest that the use of the JAS with students and housewives may be invalid, no empirical evidence is available to suggest that all JAS items have the same meaning to students and housewifes, as they do to the various populations of middle-aged, middle class, employed men, on which different versions of the JAS have been standardized.

The observation above is important, because psychosocial and psychophysiological experimental studies of the TABP have tended to recruit male and female university student subjects. Given the uncertainty surrounding the application of the JAS on student populations, caution should be exercised when interpreting these studies. The same note of caution applies to the use of the student version of the JAS. This version, referred to as Form T, was developed by Glass and his colleagues (Glass, 1977, Glass, Snyder, and Hollis, 1974; Krantz, Glass, and Snyder, 1974).

In the Form T of the JAS, items from the original adult version which dealt with income, job involvement, and job responsibility were either deleted or modified. However, Glass (1977) admits that little effort has been placed in obtaining data on the psychometric properties of the Form T. Furthermore, Glass (1977) reports only very limited data on the test-retest reliability of the Form T. Specifically, Glass mentions that out of 83 cases tested 2 to 16 weeks apart, only 9% exhibited a change in their behaviour type classification. As far as validity is concerned, various researchers have reported that behaviour type classification with the Form T of the JAS correlates only weakly (i.e, between .10 and .33 with Ns of 202 or less) with that of the SI (see

MacDougall, Dembroski, and Musante, 1979; Matthews et al., 1982; Matthews and Saal, 1978; Scherwitz et al., 1977).

The lack of data available to evaluate the properties of Form T of the JAS is of particular concern because a great number of studies designed to test the construct validity of the TABP have used this instrument to classify the behaviour type of undergraduate university students. Given the uncertainty surrounding the properties of the Form T, one must question the extent to which behavioural characteristics observed in the above studies can be said to be representative of the TABP, as measured by the SI or adult versions of the JAS in populations of employed adult males, and the extent to which the construct validity of the TABP has been demonstrated.

In the research reported in this thesis, efforts were made to meet the JAS (Form C) criteria for suitability of respondents (Jenkins et al., 1979). This issue is discussed in greater detail in Chapter 4.

1.2.3 Other methods for assessment of Type A behaviour

A variety of self-report instruments have been proposed as alternatives to the more cumbersome and lengthy protocols involved in the SI and the JAS. These have included the Framingham Scale (Haynes, Levine, Scotch, Feinleib, and Kannel, 1978), the Bortner Scale (Bortner and Rosenman, 1967), and the Vickers Scale (Vickers, 1973). However, in general, these techniques have not been widely used and their validity has not been adequately tested. Furthermore, like the JAS, they have been criticized for not tapping certain aspects of the TABP and for relying on self-reports of Type A behaviours rather than on actual observation of these behaviours in appropriately eliciting circumstances (see Byrne et al., 1985).

The Framingham Scale (Haynes et al., 1978) consists of 10 items selected by item and factor analysis, from a pool of 300 items which had originally been administered to subjects taking part in the Framingham Heart Study. Siegel (1984) criticizes the Framingham Scale, arguing that it captures the hard-driving and impatience elements of the TABP, but ignores the important anger/hostility element of the pattern. As far as its validity is concerned, low concordance rates have been reported between the Framingham Scale and the SI (see Chesney, Black, Chadwick, and Rosenman, 1981; Haynes, Feinleib, and Kannel, 1980; Haynes et al.,1978). Concordance rates between the JAS and the Framingham Scale have been equally disappointing (see Byrne et al., 1985; Haynes et al., 1980; Haynes et al., 1978). After an extensive review of the literature, only one study testing the usefulness of the Framingham Scale as a predictor of CHD could be found. In this study, Haynes et al. (1980) found that the Framingham Scale was prospectively associated with CHD incidence at an 8 year follow-up of men and women taking part in the Framingham Heart Study.

The Bortner Scale (Bortner and Rosenman, 1967) consists of 14 bipolar items in modified semantic differential format. This scale has not been widely used and there are little data on its reliability and validity. Bortner (1969) reports an inter-item reliability of .68, while Price (1979) reports test-retest reliability for a two months interval ranging from .72 to .74, for a shorter 7-item version of the scale. Concordance rates ranging from 64% to 75% have been reported between the Bortner Scale and the SI (see Bortner, 1969; Rustin et al., 1976). Furthermore, correlations between the Bortner Scale and the JAS have yielded coefficients in the low to moderate range (see Byrne et al., 1985; Herbertt, 1983; Price and Clarke, 1978).

Studies investigating the value of the Bortner Scale in predicting CHD have been relatively scarce and inconsistent. Heller (1979), for example, reports that scores in the Bortner Scale discriminated retrospectively between a group of CHD patients and a control group of subjects not suffering from CHD. However, Kornitzer, Magotteau, Degre, Kittel, and Van Thiel (1982) found no significant association between scores in the Bortner Scale and the extent of peripheral vascular atherosclerosis. More importantly, in a recent report of a large prospective British study (i.e., The Medical Research Council's Treatment Trial for Mild Hypertension), it was found that at a 5 year follow-up, scores on the Bortner Scale were not associated with recognized risk factors for CHD, MI or stroke (see Mann and Brennan, 1987).

The Vickers Scale (Vickers, 1973) is a 9-item instrument designed for research in the area of occupational stress. Vickers (1973) reports an alpha coefficient of .80, suggesting good internal consistency for this scale. However, no reliability data have been reported and validity data have been scarce. Cross-comparisons between the JAS and Bortner Scale classification have been disappointing. Byrne et al. (1985), for example, report a correlation coefficient of .41 for the association between the Vickers Scale and the JAS ($N = 587$, $p < .001$), while Herbertt (1983) observed a negative association between these two measures ($r = -.45$, $N = 205$, $p < .001$). Herbertt (1983) also reports a negative association between the Vickers Type A Scale and the SI ($r = -.41$, $N = 205$, $p < .001$). No studies investigating the association between scores in the Vickers Scale and manifestations of CHD were found in an extensive review of the literature.

Various questionnaire instruments (not originally designed to assess the TABP, but which are seen as tapping certain aspects of this construct) have been examined for their association with CHD or their ability to mimic SI or JAS classification. The description of these measures is beyond the scope of this discussion. However, it may be noted here that the Thurstone Temperament Schedule (Thurstone, 1953) and the Cook-Medley Hostility Inventory (Cook and Medley, 1954) are the most widely used of these 'non TABP specific' instruments. The former have been found to be significantly associated with SI ratings (see Chesney et al., 1981; Rahe, Hervig, and Rosenman, 1978), while the latter has been observed to be associated with manifestations of CHD (see Barefoot, Dahlstrom, and Williams, 1983; Shekelle, Gayle, Ostfeld, and Ogelsby, 1983).

Methods for the assessment of the TABP in children have also been developed (see Matthews and Angulo, 1980; Siegel and Leitch, 1981; Wolf, Sklov, Wenzl, Hunter, and Berenson, 1982). This has been an important step in the investigation of the etiology of the TABP. However, the description of such methods is again beyond the scope of the present discussion.

1.3 Components of the Type A behaviour pattern: A review of the evidence

Having described the different instruments designed to assess the TABP, attention can now be focused on studies which have provided tests of the construct validity of this behaviour pattern (as assessed by the instruments described above).

As noted earlier, Friedman and Rosenman (see Friedman and Rosenman, 1959; Rosenman and Friedman, 1959) originally identified, in an informal manner, the characteristics of Type A individuals. They conceptualized the TABP as a multidimensional construct, which has as its critical components extreme aggressiveness, easily aroused hostility, a sense of time urgency, and competitive achievement striving (see Rosenman, 1978).

Since Friedman and Rosenman's original conceptualization of the TABP and its subsequent endorsement by WCGS data (see Jenkins et al., 1979; Zyzanski and Jenkins, 1970), empirical evidence has accumulated regarding the extent to which different characteristics form part of the TABP and how they are manifested within this pattern. The multidimensional nature of the TABP has been confirmed not only by findings of diversity rather than homogeneity among measures of this construct (see

Byrne et al., 1985), but also by the great number of attributes which research has identified to be part of the construct. Price (1982), for example, found that in a review of 101 research papers (published between 1959 and 1979) describing the characteristics of the TABP, a total of 31 characteristics were mentioned. It should be noted, however, that the four characteristics that were most frequently cited were competitiveness (72 times), time urgency (62 times), aggressiveness (44 times), and drive (usually described as competitive or aggressive drive - 41 times).

The following sections present brief examples of the evidence available in support of the notion that the above mentioned, frequently cited, characteristics form part of the TABP. This evidence can be said to originate from three different types of studies: (a) those which have tested for between-types differences in physiological and behavioural responses to eliciting experimental circumstances; (b) those which have examined between-types differences in physiological and behavioural responses outside the laboratory; and (c) those studies which have investigated between-type differences in self-report measures of behaviours, attitudes and motivations relevant to the TABP. In general, the studies reviewed in the following sections are restricted to the examination of between-type differences in behavioural responses and self-report. The extensive body of literature dealing with between-types differences in physiological responding to eliciting circumstances is discussed in greater detail in Chapter 2.

1.3.1 Achievement striving, hard driving, and job involvement as components of the Type A behaviour pattern

Consistent with the hypothesized achievement striving, hard-driving, and job involved nature of Type A individuals, Howard, Cunningham, and Rechnitzer (1976) found that Type A managers reported working longer weeks, putting in more discretionary hours of work per week, and travelling more days per year than their Type B counterparts. These authors also found that the growth rate of the companies in which their subjects were employed was positively correlated to the proportion of managers working in these companies who exhibited the TABP. Although no causative link can be assumed from such data, it can be argued that the behaviour of Type A individuals was productive and beneficial to their companies and that in turn Type A individuals were reinforced through promotions for their hard driving and commitment.

Consistent with Howard et al.'s (1976) findings, Byrne and Reinhart (1989) found that scores on the JAS Type A and Job Involvement subscales were significantly associated with occupational status in a large sample of Australian public servants. Furthermore, the higher occupational status of Type A public servants appeared to be positively associated with the amount of discretionary time that these individuals were willing to devote to their job. Associations between Type A behaviour and occupational status, income, and education have also been reported by others (e.g., Mettlin, 1976; Shekelle, Schoenberger, and Stamler, 1976; Waldron, 1978; Waldron, Zyzanski, Shekelle, Jenkins, and Tannenbaum, 1977).

It is interesting to point out that the achievement striving, hard-driving and task involvement attributes of the TABP have been observed prior to the beginning of working life. This observation indicates that these behavioural characteristics may be learnt and reinforced early in life. Glass (1977), for example, found that JAS (Form T)-defined Type A undergraduate university students had participated in more sports while in high school and were involved in more extracurricular activities, as well as having received more academic honours at university, than their Type B counterparts. Glass (1977) concluded that Type A students exhibited more drive, ambition, and involvement and set higher goals for themselves, than their Type B counterparts.

Glass' (1977) observations regarding the goal setting behaviour of Type A students have been supported by others (e.g., Grimm and Yarnold, 1984; Snow, 1978). Furthermore, such behaviour has been observed in employed Type A adult males. Mettlin (1976), for example, found that in a large sample of employed adult males, JAS-defined Type A behaviour was significantly and positively associated with expectations concerning the level of job promotion to be achieved before retirement. More importantly, Mettlin (1976) also found a significant positive correlation between JAS Type A scores and subjects' perceptions regarding their employers' expectations of them. Therefore, it would appear that Type A subjects may not only set higher standards for their performance, but they may actually believe that these standards are expected of them. Type A individuals' high goal setting can be considered symptomatic of Type A individuals' achievement striving. Furthermore, it could be hypothesized that such high goal setting may lead Type A individuals to expose themselves to extreme and prolonged physical exertion and that failure to achieve unrealistic goals and to reappraise unrealistic expectations (see Snow, 1978) may lead to increased feelings of distress (see Ward and Eisler, 1987) which may in turn exacerbate the effects of physical exertion on the organism.

It should also be noted that despite the achievement striving, hard driving, and job involvement exhibited by Type A individuals, they do not always outperform Type B subjects. Type A individuals' performance superiority appears to be restricted to those tasks in which there are no constraints on duration of performance by either time limits or predetermined number of trials. That is to say, that Type A individuals may record better performances than Type Bs (who may not be as well motivated) in tasks or life situations which permit them to display their hard-driving, achievement striving, and work commitment by putting relatively more time into a task or activity or by engaging at the same time in several tasks or activities (see Carver, Coleman, and Glass, 1976; Fazio, Cooper, Dayson, and Johnson, 1981; Glass, 1977).

1.3.2 Aggressiveness and competitiveness as components of the Type A behaviour pattern

Consistent with the competitiveness hypothesized to be part of the TABP, Type A individuals have also been observed to be more interested in information that would help them evaluate their performance and abilities. Strube, Boland, Manfredo, and Al-Falaij (1987), for example, observed that when given a choice, Type A university students preferred to compare their performance on a cognitive task with that of the person who supposedly had achieved the best score in the task. Similarly, Suls, Becker, and Mullen (1981) observed that JAS (Form T)-defined Type A male university students valued feedback on their performance and that of others more than their Type B counterparts, and that they preferred to compare their performance against the best possible performance. Furthermore, Matthews and Siegel (1983) found that when given a choice, Type A children preferred to compare their performance with that of subjects at the top of a performance distribution, regardless of whether or not there were any reasons to suspect that their performance had failed to meet task demands.

Evidence that aggressiveness and aggressive competitiveness are part of Type A individuals' behavioural repertoire has been provided by examination of Type A individuals' behaviour in the laboratory situation. For example, Friedman, Byers, Diamant, and Rosenman (1975) informally observed that Type A subjects behaved in a more competitive and aggressive manner than Type Bs when competing with another subject in attempting to solve what was essentially an insoluble task. Such informal observation has been given credence by Van Egeren's (1979a) empirical findings. Van Egeren (1979a) found that JAS (Form T)-defined Type A university students interacted against an opponent in a 'mixed motive game' by conveying more competitive and hostile messages, expressing more rivalry and dominance, and conveying less reward and cooperation messages than did Type Bs. This was particularly the case when playing against another Type A. These findings are consistent with the notion that the elicitation of Type A behaviours from susceptible individuals depends on social and other environmental conditions.

Consistent with the situationally aroused aggressiveness observed in Type A subjects in Van Egeren's (1979a) study, Carver and Glass (1978) found that JAS (Form T)-defined Type A male undergraduate university students punished a confederate more harshly (i.e., 'delivered electric shocks' of higher intensity) and rated this confederate as less likeable than did Type Bs when the confederate had previously made competitive and disparaging comments about them. No between-types differences in the treatment of the confederate were observed in the absence of instigation by the confederate.

Further evidence that Type A individuals may be more interested in punishing people who provoke them to anger and experience more difficulty in modulating their expression of anger than do Type Bs, is provided in two studies carried out by Strube, Turner, Cerro, Stevens, and Hinchey (1984). Interestingly, in the first of these studies, Type A subjects were found to punish a confederate more severely than Type B subjects, but only when punishment could have no corrective effect on the confederate's performance. In the second study, which was a field experiment, Type A parents were found to punish and 'abuse' their children more frequently than their Type B counterparts.

Laboratory studies have also yielded evidence that Type A subjects may be more physiologically reactive than Type Bs in situations where they perceive competitiveness and hostility (e.g., Friedman et al., 1975; Glass et al., 1980; Van Egeren, 1979b)

1.3.3 Time urgency as a component of the Type A behaviour pattern

Consistent with the hypothesized sense of time urgency of Type A individuals, behavioural tests of between-types differences in this characteristic revealed that SI, JAS (Form T), and Bortner Scale-defined Type A subjects judged the passage of time significantly quicker than their Type B counterparts (see Bortner and Rosenman, 1967; Burnam, Pennebaker, and Glass, 1975; Price and Clarke 1978; Yarnold and Grimm, 1982). Furthermore, JAS (Form T)-defined Type A subjects have been observed to respond more impulsively and prematurely despite being aware of the required response latency (see Glass et al., 1974).

Evidence for the association between Type A behaviour and time urgency has also been obtained in studies investigating the speed with which Type A and Type B subjects perform different tasks. Bortner and Rosenman (1967), for example, observed that SI ratings correlated negatively and significantly with writing speed. Similarly, others have noted that Type A undergraduate university students complete the JAS (Form T) significantly faster than their Type B counterparts (see Yarnold and Grimm, 1982; Yarnold and Mueser, 1984; Yarnold, Mueser, and Lyons, 1987).

Grimm and Yarnold (1984) suggest that Type A subjects' apparent interest with speed of performance may be related to the higher standards of productivity which they set for themselves. Therefore, it may be reasonable to argue that under certain conditions Type A subjects' interest in speed of performance may lead to less careful and detailed consideration of aspects of the task at hand. This may be detrimental to accuracy or quality of performance. However, this may at least be partially dependent on which aspect of task performance Type As perceive as being important. Thus, under conditions in which accuracy is perceived as important and as the subject of reward, Type A individuals may be more careful in their work. Some researchers have in fact argued that Type A individuals may be less impulsive than their Type B counterparts. Price and Clarke (1978), for example, found that Type A individuals took longer to solve a mathematical problem than Type Bs. These researchers argue that their findings may be explained in terms of achievement motivation. They suggest that Type A subjects may have considered it more important to respond accurately rather than fast.

It is interesting to note recent findings indicating that Type A and Type B individuals may have a different 'time schema'. Mueser, Yarnold, and Bryant (1987), for example, found that Type A and Type B subjects conceptualize time adjectives differently. Specifically, Mueser et al. (1987) found that Type A subjects perceive time as more 'rapid' and 'energetic' than their Type B counterparts. These researchers argue that the perception of time as 'energizing' reflects the Type A individual's desire to be simultaneously involved in many goal directed activities, rather than merely attempting to perform activities rapidly.

Studies investigating possible associations between Type A behaviour and punctuality have also been cited in the literature as evidence for the time urgency component of the TABP. Research findings in this area, however, have been inconsistent. While some researchers have reported an association in student populations between JAS (Form T) Type A scores and punctuality as measured by arrival time for an experiment (see Gastorf, 1980), others have failed to replicate such finding (see Lee and Innes, 1983; Strahan, 1981). It should be noted, however, that the argument for assuming that Type A individuals will be more punctual than their Type B counterparts does not necessarily follow from commonly accepted conceptualizations of the Type A construct. Like most other behavioural characteristics exhibited by Type A individuals, punctuality may only be exhibited under certain conditions (for example, where it may enable the individual to gain or maintain control or achieve what he or she perceives as an important objective). When unmotivated or pressed by other more engaging, threatening, challenging or important events, Type A individuals may not be more punctual than Type Bs.

The impatient, time urgent component of the TABP has also been investigated in studies comparing Type A and Type B subjects' performance in reaction time tasks. Glass (1977), for example, found that Type A subjects responded more slowly than their Type B counterparts in a complex reaction time task when inter-trial intervals were long, but faster when they were short. Glass (1977) concludes that Type A individuals may have slower reactions than their Type B counterparts during long inter-trial intervals because they are more impatient and more easily distracted than Type B individuals.

1.4 Type B characteristics

The question of what are Type A characteristics brings about the issue of attempting to describe Type B characteristics. It is common for researchers to treat Type B subjects as a control group. In fact, Type B status is rarely defined or even described in the literature. When reference to it is made, it usually consists of comments suggesting that it is the opposite of Type A, or the relative absence of Type A characteristics. The consequence of adopting this approach to the treatment of Type B subjects has been that little is known about Type B behaviour and those who exhibit it, except for the fact that this behaviour appears to be associated with a decreased risk of CHD. Thus, at present, Type B appears to be equivalent to 'non Type A'.

The instrument employed to assess Type A behaviour in the studies reported in this thesis (i.e., the Form C of the JAS) treats the Type A construct as a behavioural continuum. In reality, however, all Type A behaviours may not represent a continuum nor all Type B characteristics may represent the opposite of Type A characteristics. Certain Type B characteristics may not only represent a lesser degree of intensity in a behavioural continuum, but also a qualitatively different way of responding and dealing with particular situations. Furthermore, it is possible to conceptualize the difference between the Type A and Type B patterns of responding as underlain by different interpretations of eliciting circumstances, which are in turn mediated by different psychological needs and motivations. What these motivations and needs may be, is discussed next.

1.5 Psychological constructs hypothesized to underlie the manifestation of Type A behaviour

The concept of Type A behaviour has its origins in the medical field and as such carries with it the assumption that manifested symptoms represent an underlying disorder. However, the behavioural (see Chapter 1 - Sections 1.3.1 to 1.3.5) and physiological (see Chapter 2 - Sections 2.2.2 and 2.2.3) hyper-responding exhibited by Type A individuals appear to be the symptoms of a (so far) not clearly identified underlying disorder.

A number of psychological constructs have been proposed to explain why Type A individuals are driven to exhibit behavioural and physiological hyper-responsiveness. Formulation of such constructs has generally been carried out with consideration for the situational characteristics and experimental manipulations which have been shown to elicit behaviour and physiological manifestations of the TABP from susceptible individuals. In other words, researchers have hypothesized about the needs and motivations which may drive the Type A individual, based on the identification of the types of stressors and challenges observed to elicit manifestations of the TABP.

Consideration of the psychological constructs which may underlie the manifestation of Type A behaviour is relevant to the discussion of the biological mechanisms proposed to account for the association between the TABP and CHD. Although these mechanisms are not yet clear (see Chapter 2 - Section 2.2), central to most hypotheses in the area is the notion that the situationally elicited physiological hyper-responding exhibited by Type A individuals may account for the heightened CHD risk associated with the TABP. Furthermore, consideration of the needs and motivations which may underlie the manifestation of Type A behaviours is relevant to the research reported in this thesis, because when motivated to engage in Type A behaviours, susceptible individuals may not only exhibit behavioural and physiological hyper-responsiveness, but they may also fail to become aware of symptoms (see Chapter 3 - Section 3.1.1).

The following sections present a brief description of the psychological constructs which have been hypothesized to underlie the manifestation of Type A behaviours.

1.5.1 Overdeveloped concern with the exercise and maintenance of control

Of the various psychological constructs which have been hypothesized to underlie the manifestation of Type A behaviours, the most frequently cited is that proposed by Glass (1977). According to Glass (1977), underlying the manifestation of Type A behaviours is a need or desire to attain and maintain control over the environment. Within Glass' (1977) control model of the TABP, Type A individuals are hypothesized to feel more threatened by potential loss of control over environmental events and to invest greater effort to master this threat than do Type Bs.

Evidence that Type A individuals may react to threats to personal control with behavioural hyper-responding is available from a series of studies carried out by Glass (1977). In one of these studies (Glass, 1977, p. 73) Type A subjects who had previously been threatened by their lack of control over noxious stimuli, were motivated to gain and maintain control during a subsequent task. On the other hand, Type B subjects previously exposed to a period of uncontrollability were subsequently observed to give up their efforts in gaining and maintaining control. Glass (1977, p. 80) replicated these findings in a study where controllability was operationalized in terms of the extent to which a task was capable of being solved.

Glass (1977, pp. 87 & 89) obtained further support for the notion that Type A and Type B individuals respond in a different manner to threats to their personal control in two experiments in which controllability was operationalized by manipulating reinforcement schedules. Glass found that in both experiments, Type A subjects on a variable ratio schedule reached an arbitrary criterion significantly faster than their Type B counterparts. According to Glass, Type A subjects on the variable ratio schedule felt threatened by their perceived lack of control over their reinforcement schedule and thus were more motivated to gain control than were Type Bs.

Also consistent with Glass' (1977) control model of the TABP, JAS (Form T)-defined Type A university students have been found to be sensitive to coercive attempts, to resist coercion (Carver, 1980; Snyder and Frankel, 1975), and to react strongly to loss of freedom of choice by rating non available options as more desirable (Rhodewalt and Comer, 1982). Furthermore, Type A individuals have been shown to be more reluctant to relinquish control even when such action is the most rational strategy (Miller, Lack, and Asroff, 1985; Strube, Berry, and Moergen, 1985; Strube and Werner, 1985). Type A subjects have also been found to report a higher desire for control of their environment than do Type Bs (Burger, 1985; Dembroski, MacDougall, and Musante, 1984) and to report distress when confronted with uncontrollable life events (Rhodewalt and Agustdottir, 1984; Suls, Gastorf, and Witenberg, 1979).

As noted earlier, Glass (1977) suggests that Type A individuals may react to threats to personal control with behavioural and physiological hyper-responding. However, Glass also notes that at times Type A individuals may ignore threats to their sense of control. Glass (1977) argues that Type A individuals may find threats to their sense control so distressing, that (as part of a defence strategy) they may ignore these threats when they are not particularly salient. Consistent with this hypothesis, Matthews (1979) found that Type A primary school boys and male undergraduate university students made significantly greater efforts to master a threat to personal control (over availability of reinforcement) than did their Type B counterparts, but only when such threat was made salient by experimental manipulations.

Glass (1977) also suggests that when efforts at asserting or maintaining control fail and this failure is salient, Type A individuals are likely to exhibit hypo-responsiveness or helplessness. Therefore, according to Glass (1977), whereas brief exposure to lack of control and perceived threats to their sense of control lead Type As to become hyper-responsive, prolonged failure to assert or maintain control may lead these individuals to exhibit hypo-responsiveness or helplessness. Support for this hypothesis has been inconsistent (see Brunson and Matthews, 1981; Fontana and Dovidio, 1984; Krantz, Glass, and Snyder, 1974; Lovallo and Pishkin, 1980a; Van Schijndel, De Mey, and Naring, 1984).

It should be noted that the majority of studies cited above have been carried out on populations of undergraduate university students, whose behaviour type was assessed with the student version (Form T) of the JAS. As such, the implications that these studies may have for the understanding of the association between Type A behaviour and CHD must be questioned. Nevertheless, it could be argued that Glass (1977) has provided an interesting paradigm from which to draw some tentative hypotheses about the psychological factors which may motivate the (situation-specific) manifestation of Type A behaviours. It is important to stress, however, that the experimental manipulations used to test Glass' control model of Type A behaviour involve a combination of situational characteristics, each of which may be capable of eliciting behavioural response differences between Type A and Type B individuals, irrespective of controllability per se. It is possible that a different conceptualization of the experimental paradigms used by Glass and his colleagues might conclude that the situational characteristics eliciting Type A behaviours from susceptible individuals do not constitute responses to threats regarding the possible loss of personal control, but are more appropriately defined as challenges. That is to say, that they may represent potential for reward rather than the threat of harm. In fact, Glass (1977) points out that many of his studies involved certain overtones of competition and that Type A individuals may have responded to these situational characteristics rather than to threats to their sense of control.

It is also possible to conceptualize control concerns as part of a more general psychological construct. That is to say, that Type A individuals may at times be driven by a desire for control in order to satisfy some other need. Glass (1977) himself may have hinted at this when proposing that Type As are motivated to assert control over important environmental events in an attempt to avoid anxiety resulting from the threat of failure to cope with such situations (Krantz, Glass, Schaeffer, and Davia, 1982). Furthermore, it could be argued that Type A individuals may be concerned with doing well in important events because of their need for social recognition (see Price, 1982) and that their behavioural and physiological hyper-responsiveness is promoted by situations which these individuals perceive as representing some form of social evaluation of their abilities and performance.

Poor performance or hypo-responding following prolonged exposure to failure may also be interpreted as representing psychological constructs other than classic learned helplessness. One view is that decreased responding following prolonged exposure to failure or uncontrollability may represent a rational suspension of effort in the face of evidence that the requisite abilities are not present. Such suspension of effort could also be considered consistent with an ego preservation explanation of Type A behaviour in which decrements in active coping behaviour may be seen as facilitating the Type A individual's attribution of failure to lack of effort, rather than having to make the more ego threatening attribution of failure due to lack of ability. Deterioration of performance following prolonged exposure to failure can also be considered an "ecological strategy" for exploiting resources (see Jones, 1985a, 1985b; Van Egeren, Abelson, and Sniderman, 1983). In other words, hypo-responding following prolonged failure could be interpreted as a means of husbanding resources, which are saved for struggles where success is judged to be more attainable (see Jones, 1985a, 1985b; Jones, Copolov, and Outch, 1986). Other models for conceptualizing the manifestation of Type A behaviour are discussed next.

1.5.2 Other psychological constructs hypothesized to underlie the manifestation of Type A behaviour

Price (1982) proposed a social learning framework to explain the development, maintenance, and elicitation of Type A behaviour. Specifically, Price (1982) argues that a cluster of socially derived beliefs and fears underlies the manifestation of Type A behaviours. Price (1982) links the development of these personal beliefs to socio-cultural values being communicated to children through the family, schools, and the news media. She also notes that participation in an achievement oriented materialistic society may contribute to the development of these beliefs.

Based on intensive work with Type A individuals but on little empirical evidence, Price (1982) has identified three personal beliefs, each of which is accompanied by related fears. One of these beliefs is that "positive self-evaluation is largely a function of material success". Price (1982) suggests that this belief is accompanied by a fear that "one may be judged worthless". Furthermore, she argues that this fear will motivate Type A individuals to constantly prove themselves.

A second set of beliefs identified by Price (1982) includes that "no universal moral principles exist", "good may not prevail", and "nice guys finish last". According to Price, the fear related to this set of beliefs is that good or justice may not be done and that therefore one may be unable to obtain personally advantageous outcomes. Furthermore, Price (1982) associates this fear with the manifestation of hostility.

The third belief listed by Price (1982) is that "all resources, or things worth having, are in limited supply". According to Price, the fear associated with this belief is that the individual may not get his or her share of things worth having. Price considers that such fear may be consistent with Type A individuals' achievement striving and competitiveness.

As noted above, Price's (1982) model lacks a base of systematic investigation and validation. Only one study could be found which directly evaluated the association between the TABP and the beliefs and fears suggested by Price. In this study, Burke (1984) found small but significant correlation coefficients between scores in the JAS Type A subscale and items specially designed to measured the beliefs and fears suggested by Price (1982). Despite this encouraging finding, one must conclude that Price's model (although intuitively appealing) requires further systematic investigation before it can be seriously considered as a viable framework with which to conceptualize the manifestation of Type A behaviours.

Another model which has been proposed to account for the manifestation of Type A behaviours in susceptible individuals is that of Matthews and her colleagues (Matthews, 1981, 1982; Matthews and Siegel, 1983). According to this model, Type A individuals may lack the ability to formulate standards for their performance and they may rely on social comparison information to set standards which are appropriate to the requirements of the task at hand. This notion is based on the observation that Type A children are not only encouraged to attain high goals but are also provided with more ambiguous performance feedback with which to assess progress (see Glass 1977; Matthews, 1977). Matthews (1981) argues that the effect of this ambiguous encouragement contributes to the manifestation of Type A behaviours, such as achievement striving. Matthews (1981, 1982) reasons that due to the ambiguity of the performance feedback to which they are subjected during childhood, Type A individuals fail to develop the skills necessary to set adequate standards for performance, as a consequence of which they attempt to compare their performance to those whom they perceive as superior to themselves. According to Matthews (1981, 1982), this comparison often leads Type As to the belief that they have not reached the required standards, which in turn motivates them to exert even greater efforts.

Matthews' (1981, 1982) model of the TABP appears to be supported by observations that Type A individuals are more interested than Type Bs in comparing their performance against those who have performed better than they have (Strube et al., 1987; Suls et al., 1981), even when there is no reason to suggest that their performance has been inadequate (Matthews and Siegel, 1983). Matthews' (1981, 1982) model is also conceptually consistent with findings that Type A individuals set higher performance goals than Type Bs (see Glass, 1977; Mettlin, 1976), regardless of previous performance (Grimm and Yarnold, 1984; Snow, 1978). It could be argued that by setting high goals, Type A individuals may be attempting to deal with their uncertainty regarding performance standards.

Matthews and Siegel (1983) note that the combination of highly valued productivity and the ambiguity of the standards for evaluating this productivity should lead Type As not only to the manifestation of achievement striving behaviour, but also to a sense of time passing rapidly and the impression that time is insufficient to meet all their goals.

Strube (1987) proposed a similar model to that suggested by Matthews (1981, 1982). According to Strube (1987), the manifestation of Type A behaviour is motivated by a desire to assess abilities accurately. Strube (1987) argues that Type A individuals develop a greater concern with accurate appraisal of their abilities than do Type Bs. According to this view, self-appraising behaviours are elicited by situational factors (such as failure, non diagnostic feedback or having little or no control over outcome) that increase uncertainty about one's capabilities. Therefore, Strube (1987) suggests that the major behavioural manifestations of the TABP may represent strategic attempts to reduce uncertainty about abilities.

Strube et al. (1987) report a series of studies which included manipulations designed to differentiate between an overdeveloped concern with personal control (see Glass, 1977) and reduction of uncertainty (see Strube, 1987) as possible explanations of Type A behaviour. In the first of these studies, Type A and Type B subjects were given feedback about their performance on two tests measuring separate abilities. Although the quality of performance was held constant, the clarity of performance feedback was varied for each test independently. Therefore, subjects were either certain or uncertain of their level of ability on each of the two tests. Subsequently, all subjects were required to construct a new test by choosing items that assessed the two previously tested ability domains. Additionally, all subjects were informed that they were to attempt this new test. Strube et al. (1987) found that Type As, but not Type Bs, constructed tests that were biased to assess the more uncertain domains. This finding was interpreted as supporting the notion that Type A individuals are concerned with uncertainty reduction rather than personal control. Strube et al. (1987) argue that had Type As been concerned with avoiding threats to their sense of control, they would have preferred setting themselves a task which they were certain of successfully completing.

In a second study, Strube et al. (1987) examined the possibility that uncertainty reduction, rather than concerns with control, may explain hypo-responsiveness following failure in Type A individuals. In this study, subjects were required to perform two tasks: in the first, quality of performance was manipulated so as to expose subjects to prolonged failure. Following completion of the first task, some subjects were informed that the second task assessed the same underlying ability as the first, whereas the remaining subjects were told that the second task measured completely different abilities to those measured by the first task. Strube et al. (1987) found that in the second task, Type A subjects exhibited performance decrements only when they had been led to believe that such task assessed the same abilities as the first. Furthermore, Type A subjects exhibited enhanced performance in the second task when they were led to believe that a new ability was being tested. Strube et al. (1987) argue that these findings are consistent with the notion that Type A individuals are driven by a desire to reduce uncertainty about their abilities rather than by concerns regarding personal control. According to Strube et al. (1987), had Type As been concerned with personal control, they would have exhibited hypo-responding (following failure in the first task), regardless of whether or not a new ability was tested in the second task.

Strube et al. (1987) carried out a third study, in which they found that Type A subjects were more likely to seek diagnostic information about their abilities through social comparison when they were uncertain about their level of proficiency on these abilities, than when certain as to their level of ability.

In light of Matthews' (1981, 1982) and Strube's (Strube, 1987, Strube et al., 1987) work, it is interesting to note Siegel's (1984) suggestion that Type A individuals' concern with social comparison and desire for diagnostic information may be directly associated to the higher incidence of CHD found among Type A white collar workers compared to Type A blue collar workers. Specifically, Siegel (1984) reasons that a traditional distinction between the white collar and blue collar worker is that the latter works within a more highly structured environment, which provides clearer standards for evaluating performance than that available to the former. Furthermore, Siegel (1984) argues that given Type A individuals' interest in obtaining diagnostic information about their abilities, the white collar work environment may elicit greater achievement striving and job involvement from these individuals than is elicited from Type B white collar workers (who do not share Type A individuals' interest in appraising abilities), and than Type A blue collar workers whose desire to appraise abilities may be satisfied by the more structured blue collar work environment. Relevant to this hypothesis, is the observation that SI-defined Type A individuals have been found to exhibit elevations in BP and tryglicerides in response to role ambiguity in the work environment (see Howard, Cunningham, and Rechnitzer, 1986).

Evidence has also been presented in support of the notion that the TABP may represent an egotistic or self-serving response style. For example, it has been found that Type A individuals take more credit for positive outcomes and less credit for negative outcomes than do Type B individuals (Strube, 1985; Strube and Boland, 1986) and distort their self-perceptions in a socially acceptable direction (Herman, Blumenthal, Black, and Chesney, 1981). Furthermore, it has been observed that following failure but prior to working on a second task, Type As are more likely than Type Bs to chose a performance-debilitating drug (Weidner, 1980). The choice of a self-handicapping strategy is consistent with an egotistic or self-serving response style, in that it provides the individual with an opportunity to externalize or excuse poor performance and thus protect self-esteem. Similarly, it has been argued that the deterioration of performance exhibited by Type A individuals following prolonged failure or uncontrollability (see Glass, 1977) may not represent learned helplessness but merely the withholding of effort in order to protect self-esteem (see Strube and Boland, 1986). Withholding of effort may be a useful strategy in self-esteem preservation because it allows the individual to attribute poor performance to lack of effort rather than lack of ability.

It has also been argued that the TABP may be underlain by a failure avoidance motive. For example, Gastorf and Teevan (1980) found that the scores of undergraduate university students in the Type A and Hard-Driving and Competitive subscales of the JAS were significantly associated with self-defensive motive of failure avoidance, as measured by a projective technique. Similarly, Houston and Kelly (1987) found that Type A housewives reported more fear of failure and lower self esteem than their Type B counterparts. Houston and Kelly's (1987) finding is conceptually consistent with Pittner and Houston's (1980) observation that Type As respond to self-esteem threats (operationalized in terms of failure in an 'important' task) with greater elevations in BP than those exhibited by Type B individuals. Houston and Kelly (1987) argue that the competitive, aggressive, and accomplishment-oriented behaviours of Type A individuals may reflect particular ways of avoiding fear of failure and coping with privately held feelings of low self-esteem. Friedman, Thoresen, and Gill (1981), may have hinted at this when they suggested that the characteristic competitiveness and aggressiveness commonly exhibited by Type A individuals may be due to some insecurity.

In summary then, a variety of psychological constructs have been hypothesized to underlie the manifestation of Type A behaviour. However, on the basis of current research it is not possible to determine which view provides the correct explanation. The studies cited here and in Chapter 2 (dealing with between-types differences in physiological responsiveness) suggest that Type A individuals are responsive to a number of situational characteristics. This observation seems to indicate that the manifestation of Type A behaviours may not be explained by a single underlying psychological construct.

Despite relative uncertainty about the exact nature of the eliciting circumstances and the mediating emotional-motivational state, it can be argued that between-types differences in behavioural responding to environmental circumstances may be attributed to differences between Type A and Type B individuals in their appraisal of these circumstances. That is to say, that Type A and Type B individuals may perceive and interpret certain circumstances as being more stressful, more challenging, or more important than do Type Bs. This interpretation of circumstances by Type A individuals appears to be manifested in their greater coping efforts and behavioural hyper-responding. It could be argued that differences in the early socialization histories of Type A and Type B individuals may promote between-types differences in the appraisal of certain circumstances.

1.6 Etiology of the Type A behaviour pattern

While there has been widespread acceptance of the notion that Type A behaviour constitutes a learned pattern of response to early experiences, little research has been carried out on the genetic transmission of Type A characteristics. Based on the few studies available, neither SI-defined (Rahe et al., 1978; Rosenman, Rahe, Borhani, and Feinleib, 1976) nor JAS-defined (Matthews and Krantz, 1976; Rahe et al., 1978) Type A behaviour appears to be inherited. A modest genetic contribution, however, has been reported for the Hard-Driving subscale of the JAS in a sample of university-aged twins (see Matthews and Krantz, 1976) and a similarly modest genetic contribution has been observed for the Speed and Impatience subscale in a sample of middle-aged twins (see Rahe et al., 1978).

Some researchers have emphasized the role of institutional and cultural factors in the development of the TABP. Margolis et al. (1983), for example, conceptualize the TABP as the product of the value system of western society. Margolis et al. (1983) argue that western society has a value structure which promotes excessive competitive achievement, time urgency, aggressiveness, and hostility. These researchers also suggest that western values encourage the individual to become preoccupied with the self, which in turn promotes a need for approval and acclaim, that when not met, results in the experience of anxiety. According to Margolis et al. (1983), Type A individuals driven by their need for approval, may engage in competitive and achievement striving behaviours.

Certain socioeconomic characteristics have also been identified as being related to the development of Type A behaviour. Manning, Balson, Hunter, Berenson, and Willis (1987), for example, observed that both upper-middle class urban boys and girls were more Type A than their respective lower class rural counterparts. Upper-middle-class urban girls were also observed to be as Type A as their male counterparts and more Type A than lower class rural boys. Manning et al. (1987) interpret their findings as supporting the hypothesis that the TABP is primarily a learned behaviour response, rather than a gender-linked characteristic. These findings indicate, according to the authors, that within a privileged environment in which hard work is anticipated to lead to success, upper-middle class girls can develop to be as Type A as their male counterparts and more Type A than lower class rural boys, for whom the rewards of success may not be as promising. In other words, these researchers argue that differences in Type A behaviour between urban and rural (or between upper-middle class and lower class) children may represent differences in reinforcement histories and that children who foresee only limited contingent reinforcement for the manifestation of hard-driving and competitive behaviours may not develop the TABP.

It could be argued that differences in the prevalence of Type A behaviour between upper-middle class and lower socioeconomic class children may be due not only to differences in the reinforcement of behaviour, but also to the different role models available to these children. Evidence suggesting that children imitate the Type A behaviour of their parents (see Bortner, Rosenman, and Friedman, 1970; Matthews and Krantz, 1976) lends support for this interpretation.

Imitation of parental behaviour is only one of the many types of learning experiences in general, and parental influences in particular, which may contribute to the development of Type A behaviour. It is possible that Type A behaviour may be promoted by certain child rearing practices, including those of Type B parents. There is evidence to suggest that Type A and Type B mothers may make fewer positive evaluatory comments about the performance of Type A boys than they do about the performance of Type B boys (see Glass, 1977) and that Type A boys may be pushed to try harder than Type B boys (see Glass, 1977; Matthews, 1977). Furthermore, Type A boys may be provided with ambiguous performance feedback with which to assess whether or not they have met the expectations of adults (see Matthews, 1977). According to Matthews (1981), repeated and ambiguous encouragement to try harder may cause the child to develop a strong value in productivity, and involve the individual in a chronic struggle to achieve ever escalating goals in order to obtain the approval of others.

Further evidence of differences in the childhood experiences of Type A and Type B individuals is provided by Waldron et al. (1980). These researchers observed that relative to Type Bs, Type A men recalled their fathers as being more severe, having physically punished them more often, and having made them feel more resentful rather than guilty when punished. Relative to Type Bs, Type A women recalled their mothers as having physically punished them more often. It could be argued that these experiences of parent-child interaction may contribute to the development of anger and aggression, which as mentioned earlier are important components of the TABP.

1.7 Maintenance of the Type A behaviour pattern in adulthood

Suinn (1978) suggests that western culture and its institutions provide social and material rewards which ensure the maintenance of Type A behaviours through adulthood. It could be argued that one of the most influential environments in this respect is the work place. In this environment, Type A behaviours such as achievement striving, job involvement, self-imposition of deadlines, emphasis on activity or getting things done, disregard for fatigue when attempting to complete an important task, and impatience with persons or things that prevent or delay the achievement of desired goals are likely to be reinforced by superiors. The notion that Type A behaviours are reinforced by organizations appears to be supported by observations that Type A classification is associated with income progression over a 10 year period and with number of subordinates (Mettlin, 1976).

Type A behaviour may be strongly reinforced by organizations because the productivity associated with it may be profitable for companies. The observation that Type A behaviour is related to company growth appears to be consistent with this view (see Howard et al., 1976). Given both the social and material reinforcements that are likely to be contingent on the manifestation of Type A behaviours, attempts to modify such behaviours may meet with resistance.

CHAPTER 2

2.1 Evidence for the association between Type A behaviour and coronary heart disease

Having described the different instruments designed to assess the TABP and briefly reviewed the evidence for its characteristic components, the association between Type A behaviour and coronary heart disease (CHD) incidence can be discussed in greater detail. The following sections describe both prospective and prevalence investigations of this association. Evidence for the association between the TABP and coronary artery disease (CAD) also deserves to be considered here, because it examines the relationship between Type A behaviour and a process known to contribute to coronary events.

Treatment studies investigating the effects of Type A behaviour modification programs on the incidence of CHD are also considered. It was reasoned that if the association between the TABP and CHD exists, one may expect to observe a reduction of CHD incidence or myocardial infarction (MI) recurrence upon successful modification of Type A behaviours. Studies investigating the association between individual components of the TABP and CHD are also worthy of discussion because they add validity to the multidimensional concept of coronary-prone behaviour.

2.1.1 Prevalence studies

A number of prevalence studies have found statistically significant associations between Type A behaviour and CHD. In early studies, Caffrey (1968, 1969, 1970) investigated the effects of Type A behaviour on the CHD risk of 1,400 monks. Caffrey found that SI-defined Type A behaviour related best to prevalence of CHD in combination with a Type A environment and dietary fat intake.

Wardell and Behnson (1973) studied a group of hospitalized CHD patients, hospitalized non-CHD patients, and non-hospitalized controls using a modified version of the SI. These researchers found that Type A behaviour significantly discriminated hospitalized CHD patients from other patients and controls. These findings have been replicated by others (see Keegan et al., 1979; Orth-Gomer and Ahlblom, 1980), however, in some cases SI assessment has been found to discriminate between patients and controls only in certain age groups (see Keith, Lown, and Stare, 1965).

Prevalence studies have also yielded evidence that JAS Type A scores discriminate between CHD cases and other patient groups or healthy controls (DeBacker, Kornitzer, Thilly, and Depoorter, 1977; Glass, 1977; Hiland, 1977; Jenkins, Zyzanski, and

Rosenman, 1971; Kenigsberg et al., 1974; Kornitzer et al., 1981; Zyzanski et al., 1979). In the Chicago Heart Association study (a large prevalence study of 1,211 men, aged 45-64 years), the JAS Type A scores of 57 men with a history of MI were not found to be significantly higher than those of the rest of the studied population. However, when traditional risk factors were taken into account, scores in the JAS Type A subscale were found to contribute significantly to the discrimination of MI from non-MI cases. The contribution made by Type A scores was less than that made by age and diastolic blood pressure (DBP), but similar to serum cholesterol levels (see Shekelle et al., 1976). Appels, de Haes, and Schuurman (1979) found that, although JAS Type A scores discriminated 149 patients with angina pectoris from 2,563 subjects not suffering from such condition, JAS-defined Type A behaviour did not discriminate between subjects with and without a history of MI.

Consistent with the notion that the TABP may be promoted and maintained by western values (see Margolis et al., 1983), the Honolulu Heart Study (Cohen, Syme, Jenkins, Kagan, and Zyzanski, 1979) revealed a significant association between JAS Type A scores and the prevalence of CHD in a group of Japanese-American males who had adopted a western life style (and more specifically, the time urgent and hard-driving aspects of the TABP). No such finding was observed among Japanese-Americans who had not adopted a western life style.

Generally speaking, the findings yielded by prevalence studies appear to offer consistent evidence that patients diagnosed as suffering from CHD exhibit greater number and intensity of TABP characteristics in the SI, or report more of these characteristics in the JAS. Nonetheless, caution should be exercised when interpreting data from prevalence studies. The reason for this assertion is that in prevalence studies, accurate assessment of subjects' behaviour type may be prevented by changes in behaviour, affect, and personality that may come about as a consequence of CHD being diagnosed. It could be argued that since diagnosis of CHD is often made after a sudden but traumatic event such as MI, diagnosis may have serious and long-term effects on psychological adjustment (see Garrity, 1981; Gentry, Oude-Weme, Musch and Hall, 1981).

Another factor which may contribute to inaccurate classification of subjects in prevalence studies is that post-MI patients may report more Type A characteristics than those not suffering from CHD (e.g., Jenkins et al., 1976). Byrne (1987) explains this phenomenon by suggesting that CHD patients may feel a need to justify their illness in terms of what they may retrospectively interpret as a hectic, stressful lifestyle.

It should also be noted that prevalence studies may suffer from sampling bias. For example, Matteson and Ivancevich (1980) point out that over 25% of heart attack victims die within 30 days of such episode. Therefore, the sample of post-infarct subjects available to the retrospective researcher is biased towards those who survive.

2.1.2 Prospective studies

Inferences of causality cannot be drawn from retrospective or prevalence studies; however, such inferences can be made if prospective research can show that exposure to the hypothesized causal factor pre-dates the manifestation of the disease or processes known to contribute to the disease. Therefore, the role of the TABP in the etiology of CHD should be largely evaluated by examining the extent to which prospective studies can show that behaviour type classification in initially disease-free populations is predictive of CHD.

The most significant support for the association between Type A behaviour and the development of CHD has come from the WCGS (Rosenman et al., 1964). This study investigated the incidence of CHD in 3,154 employed, middle class, healthy adult Californian males (aged between 39 and 59 years at the time of entry), who were followed up for a period of eight and a half years (see Rosenman et al., 1975). An important aspect of this study is that diagnosis of CHD was carried out by independent cardiologists who did not know subjects' status on Type A behaviour. Similarly, those persons administering and scoring the SI had no knowledge of subjects' status on traditional risk factors. At the final follow-up, it was found that the rate of new occurrence of different forms of CHD among SI-defined Type A individuals was 13.2 per thousand each year, while the rate for Type Bs was 5.9 per thousand each year (see Rosenman et al., 1975). That is to say, that for healthy Type A individuals, the risk of developing different types of CHD was 2.24 times that of healthy Type B subjects. The Type A/B risk ratio for specific types of CHD was equally impressive: 2.16 for symptomatic MI; 2.12 for unrecognized MI; and 2.45 for angina pectoris. This significant association remained after adjusting for traditional risk factors. Type A subjects' adjusted relative risk for total CHD was 1.97 times that of Type B subjects (see Rosenman et al., 1975). Furthermore, post-mortem examinations of subjects who died during the WCGS revealed that Type A subjects had a significantly greater level of CAD than their Type B counterparts (see Rosenman et al., 1975). The WCGS also provided evidence that SI-defined Type A behaviour acted not only as an independent risk factor for CHD, but that it operated through traditional risk factors such as serum cholesterol levels and elevated blood pressure (BP) (see Brand, Rosenman, Sholtz, and Friedman, 1976).

The WCGS also provided prospective evidence in support of the notion that JAS-defined TABP is a precursor of CHD. By the end of the follow-up period, 120 men (who were free of CHD at the time of completing the JAS) were found to have developed different forms of CHD. Comparison of the JAS Type A subscale scores of these subjects with those of 524 subjects who had remained free of CHD, revealed that Type A scores discriminated CHD cases from healthy controls. In a subsequent reanalysis of WCGS data, Brand, Rosenman, Jenkins, Sholtz, and Zyzanski (1978) found that men scoring in the top one third (or Type A end) of the JAS Type A subscale distribution, exhibited nearly twice the incidence of CHD over a four year period of those subjects scoring in the lowest third (or Type B end) of the distribution. The risk for CHD of those scoring in the top one third of the distribution was 1.8 times that of those scoring in the lowest one third. Brand et al. (1978) further observed that after controlling for traditional risk factors, the risk for CHD of those scoring above the WCGS mean (i.e., Type As) was 1.3 times that of those scoring below this mean (i.e., Type Bs).

Another prospective study commonly cited in the literature as evidence for the association between Type A behaviour and CHD is the Framingham Heart Study (see Haynes et al., 1978), which investigated a population markedly different to that studied in the WCGS. The population of the Framingham Heart Study included both male and female subjects in white and blue collar occupations. Analyses of the eight year follow-up data, showed significant associations between scores in the Framingham Scale and CHD for males and females aged between 45 and 64 years. These associations held after statistically controlling for traditional risk factors (see Haynes et al., 1980).

Subsequent subsidiary analyses of the Framingham data revealed some interesting points. Firstly, the association for men was restricted to those employed in white collar occupations. Secondly, the association between Type A behaviour on the one hand and CHD and angina on the other, was almost equally strong for women working at home as for women who had been engaged in paid employment for over half of their adult lives. These subsidiary analyses yielded risk ratios for total CHD of 2.9 for white collar men and 2.1 for all women. Risk ratios for MI and for angina without MI were

7.3 and 1.8 respectively for men engaged in white collar occupations, and 1.3 and 3.6, respectively for all women (Haynes and Feinleib, 1982).

Evidence in support of the prospective association between Type A behaviour and CHD has also been found outside the United States. For example, in the Belgian Heart Disease Prevention Project (DeBacker et al., 1977), JAS-defined Type A behaviour was found to successfully predict CHD (MI or sudden death) at a five year follow-up in a group of 1,958 employed men (aged between 40 to 55 years and free of CHD at entry). Furthermore, it was found that the risk for CHD of individuals scoring in the top one third of the JAS distribution was 1.9 times that of individuals scoring in the lowest one third of the distribution (see DeBacker, Kornitzer, Kittel, & Dramaix, 1983). Similar findings were yielded by the Belgian-French Cooperative Heart Study (French-Belgian Collaborative Group, 1982). This study investigated the factors predictive of CHD in 2,811 male public servants and factory workers. All subjects were free of CHD at the time of entry, when they completed the Bortner Scale. Analyses of the follow-up data (at an average of five years since entry) revealed that scores in the Bortner Scale were prospectively associated with total CHD, as well as sudden death and MI. More specifically, men scoring above the median score in the Bortner Scale, exhibited risks of 1.5, 1.4, and 1.6 times that of subjects scoring below the median, for total CHD, sudden death, and MI respectively. Furthermore, men scoring in the top quartile of the distribution of scores in the Bortner Scale had a risk for total CHD 1.8 times that of men scoring in the bottom quartile.

The Honolulu Heart Study failed to show a prospective significant association between JAS-defined Type A behaviour and CHD at an eight year follow-up, in a sample of 2,187 Japanese-American men aged between 51 and 70 years (Cohen and Reed, 1985). However, given the cultural background of these men, the low incidence of CHD and the low prevalence of Type A behaviour in the studied population, the findings of the Honolulu Heart Study should be interpreted with caution.

A number of studies have also investigated the prospective association between the TABP and CHD in high-risk populations, such as smokers, persons with high BP and/or high cholesterol levels, as well as persons with a history of prior MI. Jenkins et al. (1976) and Jenkins, Zyzanski, Rosenman, and Cleveland (1971), for example, found that JAS-defined Type A behaviour was associated with the risk of reinfarction in persons with at least one prior coronary event. In the former study, 267 men who had at least one coronary event either before or during the WCGS, were followed up for at least one year. Of these, 67 subjects experienced reinfarction during the follow-up period. A comparison of these men with those who had not experienced reinfarction, revealed that Type A behaviour as measured by the JAS was not only a significant predictor of recurrent CHD (independent of traditional risk factors), but that this variable was also a stronger predictor than cigarette smoking and serum cholesterol levels. A couple of recent studies, however, have failed to replicate the association between JAS-defined Type A behaviour and recurrent infarction (see Case, Heller, Case, Moss, and the Multicenter Post-Infarction Research Group, 1985; Shekelle et al., 1985).

Failures to observe significant prospective associations between Bortner Scale or SI-defined Type A behaviour and coronary events in populations exhibiting mild hypertension (Mann and Brennan, 1987) or high levels of cigarette smoking, serum cholesterol, and BP (The Multiple Risk Factor Intervention Trial Group, 1979; The Multiple Risk Factor Intervention Trial Research Group, 1982) have also been reported.

Generally speaking, prospective studies based on populations of originally CHD-free individuals appear to provide support for the association between Type A behaviour and CHD (see Brand et al., 1978; Brand et al., 1976; DeBacker et al., 1983; French-Belgian Collaborative Group, 1982; Haynes and Feinleib, 1982; Haynes et al., 1980 Rosenman et al., 1975). Negative findings, with the exception of the Honolulu Heart Study (see Cohen and Reed, 1985), have generally been yielded by studies investigating this association on populations of high risk individuals taking part in clinical trials (Case et al., 1985; Mann and Brennan, 1987; The Multiple Risk Factor Intervention Trial Group, 1979; The Multiple Risk Factor Intervention Trial Research Group, 1982; Shekelle et al., 1985). It is not clear why these studies have failed to replicate the results of prospective investigations with CHD-free populations. However, as noted by Matthews and Haynes (1986), the failure of high risk population studies to yield the hypothesized prospective association cannot be entirely attributed to the unreliability of self-report measures of Type A behaviour. In Shekelle et al.'s (1985) study, for example, Type A behaviour was assessed with both the SI and the JAS and yet neither measure was found to be associated with mortality from CHD or non-fatal MI. Furthermore, it should be noted that the inconsistencies in findings with high risk subjects are not restricted to studies dealing with the TABP. Studies of the predictive value of traditional risk factors in high risk populations have also resulted in inconsistent findings (see Siegel, 1984).

It is likely that the particular characteristics of the subjects recruited for high risk population studies may partly account for the inconsistencies in the findings. An example of this is the recruitment of a relatively high number of rural inhabitants and housewives in Mann and Brennan's (1987) study. Secondly, it could be argued that the chances of observing a significant association between Type A behaviour and CHD may be restricted in clinical trials with high risk individuals, because extreme Type A subjects may be reluctant volunteers for studies which require them to change their diets and stop smoking, and which involve treatment for high BP.

2.1.3 Angiographic studies

If it could be shown that the TABP is associated, albeit cross-sectionally, with CAD, this would at least tentatively suggest some involvement of Type A behaviour in the process of atherogenesis, or at least its acceleration. However, angiographic studies have yielded less consistent findings than those of the prevalence studies cited earlier (see Section 2.1.1).

Some researchers have observed that SI-defined Type A behaviour is associated with at least 75% (Blumenthal et al., 1975; Williams et al., 1980), 70% (Blumenthal et al., 1978; Krantz et al., 1979) or 50% (Frank et al., 1978) narrowing of one or more arteries. However, a number of researchers have failed to observe significant associations between SI-defined Type A behaviour and extent of CAD (see Dimsdale, Hackett, Hutter, et al., 1979; Krantz et al., 1981; Langeluddecke, Fulcher, Jones, and Tennant, 1988; Scherwitz et al., 1983). The findings of Dembroski, MacDougall, Williams, Haney, and Blumenthal (1985) are of particular concern. These researchers failed to observed a significant association between SI-defined Type A behaviour and the extent of CAD in a random sample of 131 patients from a total of 2,289, at Duke University. As pointed out by Dembroski and Costa (1987), data from this population provided the bulk of the evidence for the association between SI-defined TABP and CAD severity considered by The Review Panel on Coronary-Prone Behaviour and Coronary Heart Disease (1981). It should be noted, however, that a recent re-analysis of the entire subject population of the Duke University project revealed a significant association between SI-defined Type A behaviour and extent of CAD for those patients below the age of 60 years (see Williams et al., 1986).

Angiographic studies employing the JAS as the measure of Type A behaviour have also yielded inconsistent findings. For example, Blumenthal et al. (1978), Dimsdale, Hacket, Hutter, Block, and Catanzano (1978), and Dimsdale, Hackett, Hutter et al. (1979) failed to observe a relationship between JAS-defined Type A behaviour and the extent of artery occlusion. However, Zyzanski et al. (1976) and Stevens, Turner, Rhodewalt, and Talbot (1984) found a significant association between JAS-defined Type A behaviour and CAD. Surprisingly, however, in the latter study, the discriminability of the JAS was restricted to comparisons between those subjects with no CAD (i.e., less than 25% occlusion) and mild CAD (i.e., between 25% and 75% occlusion). The JAS did not discriminate significantly between patients with severe CAD (i.e., more than 75% occlusion) and patients with either mild or no clinically significant occlusion.

Studies employing the Bortner Scale have also yielded inconsistent findings. For example, Bass and Wade (1982) found that, contrary to expectations, high scores in the Bortner Scale were more likely among patients with no significant levels of underlying CAD, than among patients with at least one vessel occluded 50% or more. Furthermore, Kornitzer et al. (1982) failed to find any association between scores in the Bortner Scale and the number of arteries occluded more than 50%. On the other hand, Pearson (1983) found that subjects with more than 50% occlusion in any one vessel tended to score higher in the Bortner Scale than those subjects without CAD. Langeluddecke et al. (1988) failed to find a significant association between Type A behaviour, as measured by the Framingham Scale, and severity of coronary vessel disease in a population of Australian angiography patients.

Although of concern, the inconsistencies in the findings of angiographic studies do not provide sufficient basis for dismissing the association between the TABP and CHD. In this regard, it should be noted that research has also shown inconsistent associations between traditional risk factors and angiographic findings (see Pickering, 1986).

2.1.4 The association between individual components of the Type A behaviour pattern and coronary heart disease

The TABP is a multidimensional construct and it seems likely that not all components of this construct are coronary-prone. Identification of the toxic components of the TABP should prove useful in directing therapeutic priorities.

Studies employing component scoring of the SI have yielded consistent findings to support the notion that the hostility component of the TABP is an important contributor to the risk for CHD exhibited by Type A individuals. One of the most comprehensive studies investigating this association is that of Matthews, Glass, Rosenman, and Bortner (1977). These researchers matched each of 62 WCGS CHD cases for age and place of work with 124 controls subjects free of CHD, so that each case had two controls. Then the intake SIs, which had been tape recorded, were rated for content of response and for certain speech and attitudinal characteristics. Factor analysis of these data yielded five factors, only two of which were found to be prospectively associated with CHD. The items loading on these factors included: explosive voice modulation; potential for hostility; vigorous answers; and self-reported irritability at having to wait in lines. Other items which discriminated cases from controls, but which did not load on the two discriminating factors mentioned above, were: self-reported competitive involvement when playing games with peers; outwardly directed anger; and self-reported frequency of angry responses of more than one per week.

More recently, Hecker, Frautschi, Chesney, Black, and Rosenman (1985) found that SI ratings of potential for hostility were the best discriminators between 250 CHD cases and 500 matched controls at the final WCGS eight and a half year follow-up. Self-report measures of hostility, which provide an assessment of the subject's hostile tendencies independently of SI ratings, have also been found to predict 10 to 25 year incidence of CHD-related mortality, non fatal MI (see Barefoot, Dahlstrom, and Williams, 1983; Shekelle, Gayle, Ostfeld, and Ogelsby, 1983) and the extent of CAD (Williams et al., 1980), independent of traditional risk factors.

It would appear then, that hostility and anger may be important components of coronary prone behaviour. The studies cited above suggest that the association between CHD and hostility is robust, and can be found in different populations and with different measures of anger and hostility. Little is known about the predictive value of other components of the TABP, particularly those measured by the JAS. The few studies which have investigated the predictive ability of the subscales of the JAS have been inconsistent in their findings. Jenkins et al. (1974), for example, found that the Speed and Impatience, Job Involvement, and Hard-Driving Competitiveness subscales did not discriminate between CHD cases and non-cases at a four year follow-up of WCGS subjects. Similarly, Jenkins et al. (1976) found that neither of these three subscales discriminated between MI recurrent cases and non-recurrent cases at a minimum one year follow-up. On the other hand, Krantz et al. (1979) found that the Hard-Driving component of the JAS was significantly associated with the progression of CAD among men who had undergone angiography, and Kenigsberg et al. (1974) obtained prevalence data indicating that hospitalized CHD patients scored significantly higher in the Hard-Driving subcale of the JAS than control patients drawn from surgical wards.

Furthermore, Zyzanski et al. (1979) found that male patients with a previous history of MI scored significantly higher on the Hard-Driving subcale of the JAS than did healthy controls and patients free of CHD, and Kornitzer et al. (1981) found that middle-aged male patients with ECG abnormalities scored significantly higher in the Speed and Impatience subscale of the JAS than did healthy subjects. Finally, Silver, Jenkins, Ryan, and Melidossian (1980) found that scores in the Job Involvement subscale of the JAS were significantly and positively related to CAD in 105 men referred with clinical symptoms and history of CHD. It should be noted, however, that Silver et al. (1980) observed a negative association between Job Involvement and CAD in women.

In summary, although there is sufficient evidence to suggest that the hostility component of the TABP may be an important contributor to the risk for CHD implied by Type A classification, little is known about the contribution to such risk made by other components.

2.1.5 Evidence for the association between Type A behaviour and coronary heart disease from treatment studies

As indicated by Byrne (1987), if it could be shown that reductions in CHD incidence can be effected by successful manipulation and reduction of Type A behaviours, these findings should lend support to the notion that Type A behaviour and CHD may be causally linked.

The Recurrent Coronary Prevention Project was designed to investigate whether the alteration of the TABP through behavioural strategies was capable of lowering the risk of recurrent coronary events among MI patients (see Friedman et al., 1984). In this study, 882 MI male patients were randomly assigned to one of two treatment groups; a Type A behaviour intervention group, or a standard cardiology counselling control group.

Recurrence rates for clinical events of CHD were compared at a three year follow-up. This comparison revealed that the intervention group (7.2%) had a significantly lower recurrence rate for total coronary events (fatal and non-fatal), than the cardiology counselling control group (13%). It is worth noting that both groups experienced significant reductions in Type A behaviour as assessed by self-report and interview ratings, however the reduction experienced by the intervention group was significantly greater than that of the cardiology counselling control group. Since it could be argued that psychological intervention may reduce cardiac recurrence by modifying traditional risk factors, it is important to stress that in the Recurrent Coronary Prevention Project no significant differences were observed between the intervention and the cardiology counselling control groups in after treatment levels of serum cholesterol and BP (see Friedman et al., 1984).

Recently, Nunes, Frank, and Kornfeld (1987) carried out a 'meta-analysis' of 18 studies which had investigated the effect of psychological treatment on the reduction of Type A behaviours and CHD incidence. The results of each study were converted to a standardized 'effect size'. These procedures revealed that after treatment, subjects across all studies reduced their Type A behaviours by half of one standard deviation. The effect of treatment on CHD incidence was calculated using only two studies which met with the authors' admission criteria. The combined significance probability for mortality and MI at a three year follow-up in these two studies was equal to a reduction in coronary events of approximately 50% after psychological treatment.

In summary, the few studies cited above tend to suggest that Type A behaviour is amenable to modification and that such modification is associated with a significant reduction in the recurrence of cardiac events.

2.1.6 Conclusions concerning the evidence for the association between the Type A behaviour pattern and coronary heart disease

The evidence linking the TABP to CHD has been sufficiently compelling to have inspired two major conferences, both supported by the United States' National Heart, Lung, and Blood Institute. In December 1978, after the second of these conferences, the conclusions of a panel of experts (The Review Panel on Coronary-Prone Behaviour and Coronary Heart Disease, 1981; also see Cooper, Detre, and Weiss, 1981) concerning the role of the TABP in the etiology of CHD were published. This panel concluded that:

> "the available body of scientific evidence (demonstrated) that Type A behaviour (as measured by the SI, the JAS, and the Framingham Type A Scale) is associated with an increased risk of clinically apparent CHD in employed, middle-aged U.S. citizens" (p. 1200).

Furthermore, the panel stated that the risk implied by Type A behaviour is:

> "greater than that imposed by age, elevated values of systolic blood pressure and serum cholesterol, and smoking, and appears to be of the same order of magnitude as the relative risk associated with the latter three of these factors" (p. 1200).

Since the Review Panel published its findings, a few prospective studies have failed to find a significant association between the TABP (as measured by the SI, the JAS, and the Bortner Scale) and CHD in persons exhibiting high levels of traditional risk factors and patients participating in clinical trials (see Section 2.1.2). However, given possible difficulties with subject recruitment in such studies, their findings should be interpreted with caution (see Section 2.1.2).

As noted earlier, the findings from prevalence and angiographic studies have been somewhat inconsistent. It is likely that, at least in part, these inconsistencies could be explained in terms of subtle differences in the subject populations studied. However, it is important to stress that prospective investigations in populations of subjects free of CHD have provided consistent support for the causal nature of the relationship between the TABP and CHD. Furthermore, the modification of the TABP has been directly related, within a randomized clinical trial, to highly significant reductions in CHD morbidity and mortality (see Friedman et al., 1984).

The preceding discussion has addressed some of the epidemiological criteria which are commonly used in determining causation in the association between a risk factor and a disease end-point (see Hill, 1965). Such criteria, as discussed here, included the evaluation of: (a) the strength of the association between Type A behaviour and CHD as represented by risk ratios; (b) the consistency with which the hypothesized association is reported in the literature; (c) whether the literature can provide evidence of the association in studies where the assessment of Type A behaviour pre-dates the diagnosis of CHD; and (d) whether changes in the (TABP) risk factor, through controlled intervention strategies, can effect reductions in CHD incidence. One further criterion which is relevant in evaluating the association between the TABP and CHD concerns the biological plausibility of this association. Issues and evidence concerning this criterion are discussed next.

2.2 Biological mechanisms linking the Type A behaviour pattern to coronary heart disease

The observation that the TABP is associated with CHD independently of traditional risk factors (e.g., Haynes et al., 1978; Rosenman et al., 1975) has prompted researchers to propose alternative explanations for such association. Central to most hypotheses in the area is the notion that Type A individuals respond to certain environmental circumstances with greater physiological arousal than do Type Bs.

Studies investigating physiological response differences between Type A and Type B individuals have directed attention in particular to the possible contribution to CHD of the more intense sympathetic-adrenal-medullary system activity experienced by Type A individuals compared to Type Bs during challenging and/or threatening circumstances. The physiological changes associated with increased sympathetic-adrenal-medullary system activity include elevations in BP, heart rate (HR), catecholamines, myocardial oxygen consumption, concentration of free fatty acids, and plasma renin, as well as shorter pulse transit time and lower pulse volume amplitude (see Herd, 1978; Myrtek and Greenlee, 1984). Of these indicators of sympathetic-adrenal-medullary system activity, elevations in BP, HR, and catecholamines have been the most widely cited in investigations of between-types differences in physiological responding. The following Sections present a brief summary of the risk for CHD associated with elevations in these indicators of sympathetic-adrenal-medullary system activity. Furthermore, the following Sections present a brief review of the evidence for physiological response differences between Type A and Type individuals. Also considered is the ability of psychological constructs proposed to underlie the manifestation of Type A behaviour (see Chapter 1 - Section 1.5) to account for between-type differences in physiological responsiveness.

2.2.1 Mechanisms through which sympathetic-adrenal-medullary system activity may influence risk for coronary heart disease

There is evidence to suggest that frequent and intense sympathetic-adrenal-medullary system activity may contribute to the development of CHD by facilitating various pathological mechanisms. For example, elevations in norepinephrine are thought to be associated with the onset and acceleration of the atherosclerotic process by causing damage or lesions to the walls of the coronary arteries (Ross and Glonsett, 1976). Furthermore, norepinephrine has been found to mobilize lipids from adipose tissue, a process which would contribute to the formation of arterial plaques (Rosell and Belfrage, 1975). This would explain the elevated plasma tryglicerides levels (e.g., Friedman, Rosenman, and Byers, 1964; Lovallo and Pishkin, 1980b) and cholesterol (Friedman and Rosenman, 1971; Friedman and Rosenman, 1959; Lovallo and Pishkin, 1980b; Weidner, Sexton, McLelland, Connor, and Matarazzo, 1987) found among Type A individuals.

In addition, elevations in norepinephrine levels may be associated with increased cardiac output or peripheral resistance, placing extra demands on the cardiac muscle, which cannot be easily met by occluded arteries. Such state of affairs may then lead to MI (see Henry and Stephens, 1977; Williams, 1978). Eliot (1979) has indicated that high levels of norepinephrine secretion may also be responsible for the focal necrosis that is usually observed in association with severe stress.

Elevations in plasma norepinephrine have also been associated with reduced blood clotting time and aggregation of blood platelets, a process which may lead to coronary thrombosis (Ardlie, Glew, and Schwartz, 1966; Duguid, 1946). It should be noted that in Type A individuals, rapid clotting problems (see Friedman and Rosenman, 1959; Friedman et al., 1958) and aggregation of blood platelets (Simpson et al., 1974) may be exacerbated by the greater sludging of erythrocytes (i.e., red blood cells) which they appear to exhibit after consumption of a meal rich in fats (see Friedman et al.,1964; Friedman et al., 1981).

Ventricular fibrillation, leading to sudden death, has been observed to be precipitated by elevations in plasma epinephrine and norepinephrine (see Friedman et al., 1981; Herd, 1978; Kannell, Gordon, Castelli, and Margolis, 1970).

Elevations in BP and HR are thought to damage the inner layer of the coronary arteries by reducing the permeability of the cell membranes to lipoproteins,. This in turn allows cholesterol to be deposited into the cells, thus accelerating the atherosclerotic process (Clarkson, Kaplan, and Manuck, 1986). The vascular limitations imposed by CAD would then have an effect in decreasing oxygen and substrates supply to the myocardium when the individual is challenged or stressed, or when (due to some other cause) there is an increased demand for cardiac work. Failure to meet this increased demand with coronary blood flow may then lead to MI, cardiac arrhythmias, angina or sudden death (Friedman et al., 1981; Williams, Friedman, Glass, Herd, and Schneiderman, 1978).

2.2.2 Evidence for catecholaminergic response differences between Type A and Type B individuals

Studies investigating the urinary excretion of catecholamines have yielded little support for between-type differences in this variable. In a review of the relevant literature, Glass and Contrada (1987) cited only one study in support of between-types differences of urinary excretion of catecholamines. Specifically, Friedman, St George, Byers, and Rosenman (1960) found that extreme SI-defined Type A middle-aged American men exhibited a greater increase in urinary excretion of norepinephrine during working hours than did Type Bs. Interestingly, no significant between-types differences in the excretion of epinephrine and norepinephrine were observed during non-working hours. Such findings are consistent with the notion that Type A individuals may react to the challenges and stresses of the working day with greater sympathetic-adrenal-medullary system activity than Type B subjects (who do not perceive as much challenge or stress in their working environment). However, Friedman et al.'s (1960) findings were not replicated in a population of Belgian white collar workers (see DeBacker et al., 1979). Glass and Contrada (1987) point out that the lack of significant between-types differences in the Belgian study may have been due to the fact that the Belgian subjects were not extreme scorers in the SI (but rather intermediate scorers) and that the working day of Belgian white collar workers may not be as stressful and/or challenging as that of their American counterparts. A similar argument could be applied to the finding of no significant differences between JAS-defined Type A and Type B bus drivers in rest and work levels of urinary excretion of catecholamines (see Evans, Palsane, and Carrere, 1987). As noted by Siegel (1984), blue collar workers may work within a more structured and less challenging environment which does not elicit between-types differences in physiological responding.

Various other studies have reported no significant differences in the urinary excretion of catecholamines by SI and JAS-defined Type A and Type B individuals (see Frankenhaeuser, Lundberg, and Forsman, 1980; Lundberg and Forsman, 1979; Schlegel, Wellwood, Copps, Gruchow, and Sharratt, 1980). In general, however, these studies can be faulted for failing to measure urinary levels of catecholamines within a reasonable time of the stressful or challenging stimuli. As noted by Frankenhaeuser (1975), urinary catecholamines represent an estimate of sympathetic-adrenal-medullary system activity over periods of time of one to three hours. Thus, attempting to measure reactivity to stressful events which happened more than three hours prior to taking the urine sample, may be a fruitless exercise. Furthermore, in several of the studies cited above, urine samples were collected after prolonged periods of rest. The timing of urine collection may further limit the likelihood of observing situationally elicited, challenge or stress related between-types differences in the urinary excretion of catecholamines. Finally, it is important to note that even in studies where excretion of catecholamines was measured during task performance, such tasks and the circumstances surrounding their performance did not appear capable of engaging any of the psychological constructs proposed to underlie the manifestation of Type A behaviours (see Chapter 1 - Section 1.5).

Glass and Contrada (1987) cite a number of studies which although not employing direct measures of Type A behaviour, have provided support for the notion that individual components of the TABP (such as achievement motivation, hard-driving, concern with control, aggressiveness, and time urgency) are associated with elevations in the urinary excretion of catecholamines (see Bergman and Magnusson, 1979; Elmadjian, 1963, Frankenhaeuser and Kareby, 1962; Frankenhaeuser and Post, 1962; Johansson, 1973; McClelland, Floor, Davidson, and Saron, 1980; Rauste-von Wright, von Wright, and Frankenhaeuser, 1981).

The measurement of plasma levels of catecholamines is considered a useful technique in determining the impact of experimental manipulations because it allows the experimenter to assess rapid fluctuations in catecholaminergic activity. In general, studies using measures of plasma catecholamines have yielded more positive results than studies using measures of urinary excretion of catecholamines. For example, Friedman et al. (1975) found that SI-defined Type A subjects (required to compete for material reward in a cognitive task which was virtually impossible to solve) exhibited a significantly greater increase in plasma norepinephrine (from baseline) than Type B subjects. Importantly, however, no significant between-types differences in levels of plasma catecholamines were observed prior to the task or to the delivery of instructions. Therefore, Friedman et al.'s (1975) findings can be said to be consistent with the notion that elevations in sympathetic-adrenal-medullary system activity may only be elicited from Type A individuals by perceived challenges or threats.

Similar observations with respect to the situation specific nature of Type A individuals' catecholaminergic reactivity have been made by Glass, Krakoff, Contrada et al. (1980). These researchers found that SI-defined Type A middle-aged working males required to compete for a gift certificate against a highly trained, 'competitive' and 'hostile' confederate, exhibited greater elevations in plasma epinephrine (from baseline) than Type B subjects in general and Type A subjects not exposed to a 'hostile' or 'competitive' opponent. Furthermore, no between-types differences in baseline levels of plasma catecholamines were observed. These findings indicate that physiological hyper-responsiveness was elicited from Type A subjects only by highly challenging circumstances.

In their second study, Glass, Krakoff, Contrada et al. (1980) also found support for the notion that Type A subjects may react with greater elevations in plasma epinephrine when challenged to perform a task accurately and quickly, even in the absence of a competitor or material incentives. Furthermore, Glass, Krakoff, Finkelman et al. (1980) observed that SI-defined Type A individuals exhibited elevations in plasma epinephrine in response to a cognitively demanding and challenging task. Evidence that SI-defined Type A subjects may experience greater elevations than Type Bs in plasma catecholamines when exposed to conditions which threaten their sense of personal control, have also been reported (e.g., Contrada et al., 1982).

2.2.3 Evidence for cardiovascular response differences between Type A and Type B individuals

A relatively large number of studies have investigated cardiovascular response differences between Type A and Type B individuals (see reviews by De Quatro, Loo, and Foli, 1985; Holmes, 1983; Houston, 1983; Matthews, 1982; Myrtek and Greenlee, 1984). In these studies, Type A and Type B individuals have been exposed to a number of challenges and stressors, one of the most common being the threat to subjects' sense of personal control over environmental contingencies. As will be recalled, according to Glass' (1977) control model of the TABP, the manifestation of Type A behaviours is underlain by an overdeveloped concern with control (see Section 1.5.1). Thus, researchers have reasoned that such concern with control would manifest itself in behavioural as well as physiological hyper-responsiveness, in situations where control is threatened (see Contrada et al., 1982).

Investigations of between-types differences in cardiovascular reactivity in conditions designed to threaten subjects' sense of personal control have yielded inconclusive findings (see Contrada et al., 1982; Nielson and Neufeld, 1986; Pittner, Houston, and Spiridigliozzi, 1983; Van Schijndel et al., 1984). Of particular concern is the observation made by Nielson and Neufeld (1986) that in some of these studies (i.e., Contrada et al., 1982; Nielson and Neufeld, 1986; Pittner, Houston, and Spiridigliozzi, 1983) Type A subjects have been shown to exhibit greater BP and HR reactivity in conditions which involved a relative absence of control options or in conditions where control was not threatened, than in conditions where (although control was threatened) there was a possibility to control environmental contingencies. Such findings are inconsistent with Glass' (1977) control model, because this model predicts that Type A subjects may exhibit behavioural and physiological hyper-responsiveness in conditions where although control is threatened, they believe that control is possible and they have the opportunity to exercise control.

The investigation of between-types differences in cardiovascular reactivity has also been carried out in studies other than those designed to test Glass' (1977) control model. In particular, a large number of studies have investigated the notion that Type A individuals' cardiovascular reactivity may be elicited by so called 'Type A relevant' challenges and stressors. The term 'Type A relevant' refers to situations or challenges which elicit task involvement or promote competition, time pressure, or other Type A characteristics (see Goldband, 1980). This term, however, is not very useful in clearly conveying the specific situational characteristics which are proposed to elicit the TABP and its accompanying physiological hyper-responsiveness. Given the rather loose nature of this term, it is not surprising that a wide range of experimental manipulations, tasks, and instructions have been used by researchers attempting to produce 'Type A relevant' eliciting environments.

The wide range of so called 'Type A relevant' experimental situations under which Type A and Type B subjects' cardiovascular reactivity has been studied, makes it difficult to arrive at any firm conclusions regarding the situational characteristics which may elicit cardiovascular hyper-responsiveness from Type A individuals. Nonetheless, general themes can be identified from this literature. In particular, it should be noted that JAS (Form T)-defined Type A male university students have been found to exhibit greater HR and/or systolic blood pressure (SBP) elevations than their Type B counterparts during performance of relatively difficult tasks in which the importance of doing well and the need for accurate and rapid performance had been emphasized by experimental instructions (see Dembroski, MacDougall, and Shields, 1977, 1978; Manuck and Garland, 1979; Manuck, Craft, and Gold 1978).

The notion that Type A subjects may be selectively reactive to difficult task and/or tasks which are perceived as important is further supported by Golband's (1980) findings. Golband found that during performance of a difficult reaction time task which had been introduced with instructions emphasizing task importance and competition, JAS (Form T)-defined Type A university students exhibited a greater decrease in pulse transit time (which is associated with BP elevations) than Type A subjects who were simply told that the reaction time task was 'make work'. No such response difference was observed among Type B subjects. Therefore, in Golband's (1980) study, it was only when challenged by instructions emphasizing competition and task importance that Type A subjects exhibited physiological hyper-responsiveness. Type B subjects, on the other hand, exhibited low levels of physiological arousal irrespective of instructions. Furthermore, in a second study Goldband (1980) observed that Type A subjects did not exhibit cardiovascular hyper-responsiveness to tasks which did not emphasize task importance or difficulty. More precisely, Golband (1980) found no between-types difference in pulse transit time or HR during a balloon inflation and a cold pressor tasks presented with instructions devaluing the importance of performance in these tasks.

Consistent with Golband's (1980) observations, Dembroski, MacDougall, Herd, and Shields (1979) found that JAS (Form T)-defined Type A university students exhibited greater HR and SBP elevations than their Type B counterparts when performing a cold pressor and a reaction time tasks which had been presented with instructions emphasizing task difficulty, importance of performance, and the need to do well. However, no-between types differences in cardiovascular reactivity were observed when subjects performed the cold pressor and reaction time tasks without the instructions described above. Similarly, Lott and Gatchell (1978) and Scherwitz, Berton, and Leventhal (1978) failed to observe between-types differences in cardiovascular reactivity to a cold pressor task presented without instructions emphasizing competition or the importance of performance.

In summary , the studies described so far seem to indicate that Type A subjects exhibit cardiovascular reactivity in response to perceived task difficulty and/or in response to instructions emphasizing task importance and the need for accurate performance. Furthermore, the evidence reviewed thus far suggests that Type A individuals are not chronically physiologically hyper-responsive to all stressors and/or challenges.

Situations tapping the competitive characteristic of the TABP have also been observed to elicit cardiovascular hyper-responsiveness from Type A individuals. For example, JAS (Form T)-defined Type A university students have been found to exhibit greater elevations in HR than their Type B counterparts in experimental situations requiring them to compete with an aggressively competitive opponent (Van Egeren, 1979b). Furthermore, JAS (Form T)-defined Type A university students have been found to respond with greater elevations in digital blood volume pulse when competing against other Type A subjects than when competing against Type B subjects (Van Egeren, 1979a). This observation serves to once again emphasize the situation specific nature of Type A individuals' physiological reactivity. The fact that the more relaxed and non competitive approach of Type B individuals does not elicit cardiovascular hyper-responsiveness from Type A subjects and that only interaction with other Type A subjects does so, is consistent with the notion that the TABP is not a chronic response pattern, but one which is elicited from susceptible individuals by 'Type A relevant' environmental circumstances.

There is also evidence that Type A subjects may be selectively responsive to threats to their self-esteem. For example, Pittner and Houston (1980) found that Vickers Scale-defined Type A university students who had been informed that their performance in a task was not as good as that of others ("Threat to Self Esteem" Condition) responded with significantly greater SBP and DBP elevations than Type B subjects in general, Type A subjects informed that they were "doing fine" (Low Stress" Condition), and Type A subjects threatened with "painful" shocks ("Threat of Shock" Condition). Furthermore, no between-types differences were observed in the "Low Stress" and "Threat of Shock" Conditions. Therefore, in Pittner and Houston's (1980) study, Type A subjects exhibited cardiovascular hyper-responsiveness when having to perform a task which threatened their self-esteem and public image, but did not experience such hyper-responsiveness when there was no threat to self-esteem or when they faced threats of physical pain. Consistent with Pittner and Houston's (1980) observations, Lulofs, van Diest, and van der Molen (1986) found that JAS-defined Type A middle-aged subjects exhibited higher cardiovascular arousal than their Type B counterparts when informed that they were performing badly in a reaction time task. Importantly, however, Lulofs et al., found that when receiving positive feedback about their performance, Type A subjects exhibited less cardiovascular arousal than Type Bs. Thus, once again it would appear that criticism of performance may represent an ego threat to which Type A subjects react with greater cardiovascular arousal than Type Bs.

Threats to self esteem promoted by instructions implying that a task is diagnostic of intellectual ability have also yielded between-type differences in cardiovascular reactivity. For example, Holmes, Solomon, and Rump (1982) found that JAS (Form T)-defined Type A male university students exhibited a significantly higher HR response than their Type B counterparts while performing a psychomotor task which was presented to them as a "very important" and "very sensitive intelligence test".

These researchers observed that Type A subjects exhibited a HR increase that was 14.6 bpm higher than that of Type B subjects. Viewed in another way, Type A males exhibited a HR elevation (from baseline) of 20.3 bpm (an increase of 27% over their resting HR), whereas Type B males exhibited a HR elevation of only 5.7 bpm (which represented an increase of 8% from resting levels). Similar findings were obtained by Malcom, Janisse, and Dyck (1984), who observed that JAS-defined Type A male army personnel exhibited significantly greater HR elevations than their Type B counterparts while performing a cognitive task presented as a test of "verbal intelligence". It should be noted, however, that recently, Lutz, Holmes, and Cromer (1987) failed to observe between-types differences in cardiovascular reactivity during performance of a cognitive task which had been introduced as an "important intelligence test".

An exhaustive review of the literature dealing with between-types differences in cardiovascular responding was judged to be beyond the scope of this thesis. For such review the reader is referred to Holmes (1983), Houston (1983), Matthews (1982), and Myrtek and Greenlee (1984). These reviews include reports of lack of significant between-types differences in cardiovascular reactivity in a range of experimental conditions. (see Holmes, 1983; Houston, 1983; Matthews, 1982; Myrtek and Greenlee, 1984). Inconsistencies in findings may stem from the use of different stressors and challenges, as well as the use of different subject groups and different instruments for measuring the TABP. A further important factor is that a large number of the studies in the area have been carried out on populations of undergraduate university students, for whom the CHD implications of Type A classification and cardiovascular reactivity are not well established.

Despite the inconsistent findings referred to above, it is possible to draw some tentative conclusions about the trends which appear to be present in the literature. Firstly, it would appear that cardiovascular reactivity in Type A individuals is not a chronic phenomenon, but rather one that is situationally elicited by certain challenges and stressors. This is evident in the fact that extremely few studies have yielded between-types differences in cardiovascular reactivity during baseline, inactivity or during activity which does not involve what could in some way be construed as posing a challenge or a threat (see Holmes, 1983; Houston, 1983; Matthews, 1982; Myrtek and Greenlee, 1984). It must be stressed, however, that the exact nature of the eliciting circumstances and the needs and motivations which they may tap remain the subject of debate. Nonetheless, it would appear that the situation specific cardiovascular reactivity of Type A individuals may be cognitively mediated. It would seem that Type A individuals may exhibit cardiovascular reactivity in conditions where they perceive a threat to their sense of personal control, self esteem or public image and where situational characteristics emphasize competitiveness and/or the task is perceived as important and/or difficult.

2.2.4 Other biological and psychosocial mechanisms by which the Type A behaviour pattern may be associated with coronary heart disease

Apart from the possible pathological mechanisms involved in frequent and intense sympathetic-adrenal-medullary system activity, Type A behaviour may also be associated with CHD through its impact on the pituitary-adrenal-cortical system. Activation of this system may lead to vasoconstriction of the skeletal muscles, which in turn may result in high blood pressure (see Williams, Bittner, Buschbaum, and Wynne, 1975). The observation that both vigilance and anticipatory behaviour have been associated with activation of the pituitary-adrenal-cortical system (see Henry and Stephens, 1977) and the fact that Type A individuals appear to be hyper-vigilant to different aspects of their environment, may indicate a possible linking mechanism between the TABP and CHD.

Given the hypothesized association between low self esteem and reduced activation of the pituitary-adrenal-cortical system (see Henry and Stephens, 1977), the observation that Type A behaviours may represent overt manifestations of feelings of insecurity and inferiority (see Friedman et al., 1981; Price, 1982) may suggest a further process by which to explain the association between the TABP and CHD.

If as hypothesized by Glass (1977), Type A individuals are involved in a continuous struggle for control, alternating between trying hard and feeling helpless, such shifts in behaviour could also account for the enhanced CHD risk of Type A individuals. It could be argued that rapid shifts from sympathetic (i.e., hyper-responsiveness) to parasympathetic (i.e., hypo-responsiveness) dominance and the rise and fall of catecholamines may be implicated in the etiology of CHD and sudden death (see Engel, 1970; Richter, 1957; Seligman, 1975).

A number of studies have also shown that after task completion or upon withdrawal of the source of challenge or threat, Type A subjects recover from cardiovascular and catecholaminergic reactivity more slowly than Type Bs. (see Evans and Moran, 1987; Frankenhaeuser, 1980; Hart and Jamieson, 1983; Jennings and Choi, 1981; Steptoe and Ross, 1981). Such slow recovery from physiological arousal has been hypothesized to be as important as the intensity of initial reactivity in contributing to enhanced risk for CHD (see Buell and Sime, 1979).

Some researchers have also attempted to explain the association between Type A behaviour and CHD in terms of the mediating effects of stressful life events. Specifically, it has been argued that Type A individuals may behave, albeit unwillingly, in such a way as to increase the likelihood of experiencing life events (Byrne, 1981; Lutz et al., 1987; Suls et al., 1979; Tennant and Andrews, 1978). Research has in fact revealed that Type A behaviour is related to self-reported frequency of life events in samples of healthy subjects (see e.g., Burke and Weir, 1980; Byrne and Rosenman, 1986; Rhodewalt and Agustdottir, 1984; Suls et al., 1979) and more importantly, these significant correlations have been replicated in samples of CHD patients (see Dimsdale et al., 1978; Byrne, 1981; Falger, Bressors, and Dijkstra, 1980).

Given that significant increases in life stress have been found to precede illness episodes in general (e.g., Andrews, 1978; Dohrenwend and Dohrenwend, 1974; Levi, 1971; Schroder and Costa, 1984) and clinical manifestations of CHD in particular (see Byrne and Whyte, 1980; Connolly, 1976; Liljfors and Rahe, 1970; Rahe, Romo, Bennet, and Siltanen, 1974; Theorell, 1974; Theorell and Rahe, 1972, 1975), the observation that Type A individuals may experience more life events than Type Bs may provide an alternative explanation of the association between the TABP and CHD.

It is also interesting to point out that Type A individuals may exacerbate their risk for CHD by their apparent failure to attract social support. Data concerning the relationship between social support and health suggest that weak or inadequate ties with others may add to the health risk associated with stressful life events (see Berkman, 1984; Cohen and Wills, 1985). Relevant to this point is the finding that Type A behaviour in men is associated with reports of having fewer friends, less social support, less use of talking to others as a coping strategy (see Burke et al., 1979), and more marital discord (see Blaney, Brown, and Blaney, 1986; Burke, Weir, and Duwors, 1979; Falger, 1983). It has been suggested that due to their aggressiveness and hostility, Type A individuals may not benefit from the buffering effect that social support is thought to have in protecting the individual from stressful events (see Weidner et al., 1987).

2.3 Summary of issues addressed in Chapters 1 and 2

The term 'TABP' has been coined to refer to a set of characteristics which large prospective epidemiological studies have demonstrated to be coronary-prone. The characteristics making up this multidimensional construct include aggressiveness, achievement striving, competitiveness, time urgency, and job involvement. These behavioural characteristics appear to represent ways in which Type A individuals deal with certain challenges, threats and stressors. The literature suggests, however, that Type A individuals may not constantly exhibit Type A characteristics regardless of situational context, but rather that these characteristics are situationally elicited. This observation is consistent with Rosenman's (1978) conceptualization of Type A behaviour as being the observable outcome of a person-situation interaction, which is only elicited in susceptible individuals by "appropriately" challenging and/or stressful circumstances. However, the specific nature of these eliciting circumstances and the motivations and needs which underlie behavioural and physiological reactivity in these circumstances are not yet clear. Tentative observations yielded by a review of the literature appear to indicate that as far as physiological hyper-responding is concerned, this may be mediated by Type A individuals' appraisal of environmental circumstances as being difficult, important or as posing a threat to their sense of personal control, self esteem, or public image.

Various biological and psychosocial mechanisms have been proposed to account for the association between the TABP and CHD. These have included intense sympathetic-adrenal-medullary system activity, activation of the pituitary-adrenal-cortical system, rapid shifts from sympathetic to parasympathetic dominance, greater life events-associated stress, and lack of social support. An alternative explanation of the association between Type A behaviour and CHD, which has not yet been considered, is the suggestion that any risk associated with greater cardiovascular and catecholaminergic reactivity may be exacerbated by Type A individuals' apparent unawareness of the symptoms produced by such reactivity (e.g., Weidner and Matthews, 1978). Furthermore, it could be argued that even if cardiovascular and catecholaminergic reactivity do not contribute towards the risk for CHD associated with the TABP, it is possible that failure to become aware of symptoms and the implications which this may have for self-regulation and health-related behaviours may represent a risk factor in its own right. The investigation of issues concerning Type A individuals' awareness of symptoms is the objective of the research reported in this thesis. Before describing this investigation, Chapter 3 presents an overview of the relevant literature and identifies the questions for research.

CHAPTER 3

3.1 Type A behaviour and the report of symptoms

Various researchers have observed that, despite exhibiting greater physiological reactivity and effort expenditure than Type Bs, Type A individuals tend to report less physical and emotional distress symptoms. However, there has been relatively little systematic research aimed at identifying the mechanisms underlying such phenomenon. Furthermore, the few research studies which have attempted to address this issue have taken a rather indirect approach, employing experimental paradigms and stimuli which appear to have little relevance to symptom experience. This detracts from the strength of the conclusions that can be drawn.

Identification of the mechanisms which may lead Type A individuals to report less symptoms than Type Bs and fewer symptoms than would be expected in the presence of high levels of physiological arousal and effort expenditure, may be important to an understanding of the relationship between the TABP and coronary heart disease (CHD). For example, given the role of symptom perception in self-regulation (e.g., Carver and Scheier, 1982; Leventhal, Nerenz, and Strauss, 1980; Schwartz, 1983), it could be argued that, if Type A individuals are unaware of or unwilling to acknowledge physical sensations, they may over exert their bodily capacity and thus facilitate the onset and exacerbation of pathology and delay treatment-seeking or other remedial actions. This view is consistent with Control System Theory, which predicts that failure to attend to symptoms may lead to the disruption of self-regulatory mechanisms (see Carver and Scheier, 1982; Leventhal, Nerenz, and Strauss, 1980; Schwartz, 1983). In the long run, such inability to use symptoms as cues to alter behaviour or seek treatment may contribute to the risk for CHD associated with the TABP. If Type A individuals have a higher threshold for noticing symptoms, they may work their body closer to its limits for longer periods of time than Type Bs and they may allow early symptoms of pathology to go untreated.

Furthermore, Type A individuals' failure to become aware of, or acknowledge, internal cues of distress may cause them to delay seeking treatment during or following acute coronary events. Such a consideration is important given that a crucial factor contributing to survival following myocardial infarction (MI) is the speed with which treatment is received (see Doerhman, 1977; Leitch, Birbara, Freedman, Wilcox, and Harris, 1989). The observation that Type A coronary patients tend to exhibit greater severity of atherosclerosis when examined in hospital for suspected MI (e.g., Blumenthal et al., 1975, 1978; Frank et al., 1978; Krantz et al., 1979; Stevens et al., 1984; Williams et al., 1986, 1980; Zyzanski et al., 1976) appears to be consistent with the notion that Type A individuals may delay seeking treatment for MI related symptoms.

The implications of Type A individuals' relatively lower symptom report are discussed in greater detail in Chapters 8 and 9. The following sections are intended to provide an overview of research in the area of between-types differences in symptom report, introduce relevant issues, and identify questions in need of further investigation.

Before introducing the relevant literature, it should be noted that laboratory investigations of between-types differences in the report of physical and emotional distress symptoms have generally relied on objective measures of physiological arousal or effort in order to evaluate the relative 'adequacy' of subjects' self-report. For example, measures of heart rate (HR), blood pressure (BP), and oxygen uptake have been used to evaluate whether the number or intensity of self-reported symptoms such as racing heart, exertion, and anxiety are consistent with the level of arousal or effort suggested by physiological measures. It should also be noted that, in general, it has been the relationship between physiological and self-report measures exhibited by Type Bs that has been treated as the norm by which the adequacy of Type A subjects' self-report has been assessed. Field and survey studies have not generally employed objective measures of physiological arousal or effort, but, like their laboratory counterparts, have treated the symptom report pattern of Type Bs as the reference by which to assess the adequacy of Type A subjects' symptom report. This procedure appears to stem from the conceptualization of Type B subjects as a convenient control group.

Finally, it should be noted that in this thesis, Type A individuals' failure to report symptoms or the full extent of symptoms is often described as 'under-report'. This term has been employed previously by others, for reasons of brevity, to refer to the fact that Type A individuals report fewer symptoms, less frequent symptoms, or less intense symptoms relative to Type Bs or relative to objective measures of physiological arousal and physical exertion.

3.1.1 Evidence for between-types differences in symptom report

One of the first investigations of the symptom report behaviour of Type A individuals was carried out by Carver, Coleman, and Glass (1976). These researchers required JAS (Form T)-defined Type A and Type B male university students to walk on a motorized treadmill, while rating their fatigue at two-minute intervals. Prior to the commencement of the treadmill task subjects were informed that they would be required to exercise for a predetermined length of time. However, subjects were also informed that they could terminate the test prior to this predetermined time by indicating their desire to stop. In reality there was no predetermined length of time and all subjects terminated their involvement in the treadmill task by indicating that they wished to stop.

Carver et al. (1976) found that Type A subjects reached a significantly greater oxygen absorption rate (91.4% of their aerobic capacity) than Type Bs (82.8% of their aerobic capacity) before deciding to stop exercising on the treadmill. Furthermore, analysis of subjects' fatigue ratings revealed that Type A subjects reported significantly less fatigue than Type Bs even towards the end of the exercise period (when fatigue had supposedly set in). Carver et al. (1976) conclude that their findings reflect Type A individuals' hard-driving and competitive nature. Specifically, these researchers argue that Type A individuals "suppressed" feelings of fatigue because this enabled them to continue to perform at a high level despite veridical feelings of fatigue. Furthermore, Carver et al. (1976) argue that such a motive is consistent with Glass' (1977) control model of the TABP (see Chapter 1 - Section 1.5) in that suppression of fatigue supposedly allowed Type As to maintain control over task demands.

Carver et al. (1976) do not explain in detail their use of the term "fatigue suppression". Instead, they simply refer to this term as the opposite of "acknowledgement of fatigue". It is not clear from such a definition, how deliberate or conscious Carver et al. consider the process of "suppression" to be. In a subsequent study of JAS-defined Type A and Type B female university students, DeMeersman, Schaefer, and Miller (1984) failed to replicate Carver et al.'s (1976) findings of between-types differences in effort expenditure. Although this inconsistency in findings may be related to the different gender of the subject populations employed by the two research groups, the replicability of Carver et al.'s (1976) findings remains to be demonstrated.

Weidner and Matthews (1978) investigated the possibility that Carver et al.'s (1976) observation of between-types differences in the report of fatigue could apply to other physical symptoms. Weidner and Matthews (1978) required JAS (Form T)-defined Type A and Type B female university students to rate a list of 14 symptoms when stopped in the middle of a simple arithmetic task or at the end of it. Furthermore, subjects were allocated to one of three noise conditions, "Unpredictable Noise", "Predictable Noise", and "No Noise". Subjects were also allocated to one of two conditions of expected task duration. Specifically, half of the subjects in each noise condition were allocated to the "Eight-Minute Expected Task Duration" Condition, while the remaining half were allocated to the "Four-Minute Expected Task Duration" Condition. Subjects in the 'Eight-Minute' Condition were informed that they would be working on the arithmetic task for eight minutes, while subjects in the 'Four-Minute' Condition were informed that they would be working on the arithmetic task for four minutes. In reality all subjects worked on the arithmetic task for four minutes and measures of symptom report were completed at the end of this period. It is important to note, however, that subjects in the 'Eight-Minute' Condition were led to believe that after completion of the symptom self-report instrument, they would continue working on the arithmetic task for a further four minutes. It should also be noted that all subjects were asked to report symptoms retrospectively. That is to say that they were asked to rate the extent to which they had experienced each of the 14 symptoms during task performance rather than what symptoms they were experiencing at the time of making the ratings.

Weidner and Matthews (1978) hypothesized that, if as argued by Carver et al. (1976), Type A individuals failed to acknowledge symptoms as a way of protecting performance against symptom-induced deterioration, Type A subjects in their study would only under-report symptoms when faced with ongoing task performance. In other words, Weidner and Matthews (1978) hypothesized that only Type A subjects who stopped to rate symptoms in the middle of a task (i.e., 'Eight-Minute' Condition subjects) would under-report symptoms. Weidner and Matthews (1978) expected Type A subjects who at the time of report had completed the task (i.e., 'Four Minute' Condition subjects) to be able to retrospectively report symptoms (which had occurred during task performance). This expectation seems to imply that these researchers conceptualize "suppression" (Carver et al., 1976) as involving denial of symptom information which once the task is over can be acknowledged or retrieved.

Consistent with their hypothesis, Weidner and Matthews (1978) found that Type A subjects expecting to continue working in the arithmetic task (i.e., 'Eight-Minute' Condition subjects) reported fewer and less intense symptoms than Type A subjects who had completed the task (i.e., 'Four-Minute' Condition subjects) and than Type Bs in general. Type A subjects in the 'Eight-Minute' Condition reported less intense racing heart, sweaty hands, flushed face, and dizziness. As far as measures of physiological arousal are concerned, only systolic blood pressure (SBP) differentiated between the types, with Type A subjects in the "Predictable Noise" Condition exhibiting greater elevations in SBP than their Type B counterparts.

Contrary to Weidner and Matthews' (1978) hypothesis, however, it was found that Type A subjects, regardless of expected task duration, admitted to the same level of symptom and noise-induced task disruption as did Type Bs. Accordingly, Weidner and Matthews (1978) concluded that Carver et al.'s (1976) concept of symptom "suppression" as a mechanism for preserving task performance, was incapable of explaining the symptom under-report exhibited by Type A subjects in the 'Eight-Minute' Condition. More specifically, they argued that if Type A subjects in the 'Eight-Minute' Condition had "suppressed" symptom awareness in order to assert control over task demands, they should have not only reported less symptoms than others when stopped in the middle of the task, but also admitted to less symptom and noise-induced task disruption than others.

Furthermore, Weidner and Matthews (1978) concluded that their findings could not be explained in terms of the notion that Type As were chronically less sensitive to symptoms, because this explanation would have required Type A subjects in the 'Four-Minute' Condition to have also exhibited symptom under-report. Instead, Weidner and Matthews (1978) tentatively concluded that while "preoccupied" with performance in a challenging task, Type A subjects may focus their attention on the performance of that task at the expense of task-peripheral stimuli (such as symptoms). Weidner and Matthews (1978) also argued that in their study, Type A subjects asked to rate symptoms when stopped in the middle of the arithmetic task (i.e., 'Eight-Minute' Condition subjects) may have still been attending to the task, while subjects asked to rate symptoms at the end of the task found it no longer necessary to attend to the task and thus were able to process symptom related information. However, Weidner and Matthews' (1978) findings offered at best inconsistent support for the above hypothesis. Firstly, it can be argued that if all Type A subjects allocated attention maximally to the arithmetic task, those in the 'Four-Minute' Condition, should have been as incapable as their 'Eight-Minute' Condition counterparts of retrospectively reporting symptoms which had occurred during task performance. Secondly, it is not clear how Weidner and Matthews (1978) propose to explain the fact that those Type A subjects found to under-report symptoms (and who supposedly did not process symptom information to the same extent as others) admitted to the same level of symptom-induced task disruption as other subjects.

Therefore, although the notion that Type A individuals may feel so challenged by a task that they need to allocate attention maximally to the task at the expense of other stimuli is intuitively appealing, the data yielded by Weidner and Matthews's (1978) study do not appear to be completely consistent with this explanation.

Following Carver et al. (1976) and Weidner and Matthews' (1978) studies a number of investigations have yielded evidence to confirm between-types differences in symptom report. Although, generally speaking, these investigations were not designed to evaluate any particular hypothesis regarding the underlying causes of Type A subjects' symptom under-report, they have tended to provide tentative support for the notion that Type A individuals may under-report symptoms which supposedly occurred during periods of perceived challenge or demand. Schlegel et al. (1980), for example, observed that the number of cardiovascular symptoms reported by SI-defined Type A, middle-aged, male coronary out-patients (who were required to maintain a symptom and activity diary for two weeks) was moderately and negatively correlated with perceived challenge in daily activities. On the other hand, the number of cardiovascular symptoms reported by Type B subjects was found to be moderately and positively correlated with perceived challenge in daily activities. Similarly, Swan, Chesney, Black, Ward, and Rosenman (1986) found that healthy SI-defined Type A adult males reported significantly fewer cardiovascular and fatigue-related symptoms than Type Bs during the working day.

Evidence has also been reported suggesting that following challenging or demanding circumstances, Type A individuals may retrospectively under-report symptoms of emotional distress occurring during those circumstances. Holmes et al. (1982), for example, found that in response to a task presented as a "very sensitive intelligence test", JAS (Form T)-defined Type A university students exhibited a mean HR elevation (from baseline) which was almost four times higher than that of their Type B counterparts. However, no between-types differences were found in post-task retrospective reports of elevations in state anxiety. It could be argued that given the long standing link between elevated autonomic arousal and the experience of emotional discomfort (see Claridge, 1967), the greater HR elevations exhibited by Type A subjects in Holmes et al.'s (1982) study, should have been associated with higher levels of self-reported anxiety. It is possible then, that Holmes et al.'s (1982) findings may represent a further example of Type A individuals' tendency to under-report symptoms when confronted with challenging and demanding circumstances.

Manuck et al.(1978) obtained similar results to those of Holmes et al. (1982). Manuck et al. found that Type A university students required to perform a difficult cognitive concept formation task exhibited significantly greater elevations in SBP than their Type B counterparts. However, despite this fact, no between-types differences were observed in post-task retrospective reports of elevations in state anxiety. Similar findings have been obtained by others (see Dembroski et al., 1978; Manuck and Garland, 1979; Pittner and Houston, 1980). Furthermore, Malcom, Janisse, and Dyck (1984) found that, despite exhibiting significantly greater elevations in HR in response to a cognitive task, JAS (Form C)-defined Type A male adults reported significantly less anxiety than their Type B counterparts.

Various studies have also yielded evidence indicating that during periods of perceived challenge or demand, Type A individuals may fail to interpret symptoms as indicative of illness. Matthews, Siegel, Kuller, Thompson, and Varat (1983), for example, found that in a group of patients admitted to hospital for suspected infarct, self-reported anger in the SI was significantly and positively correlated with delay between the time a patient noticed symptoms and the time these symptoms were interpreted as signs of illness. Importantly, self-reported anger was found to be associated with the experience of little initial pain at a time when work was very demanding. Furthermore, self-reported pressure drive and self-reported anger were significantly and positively correlated with delay between pain onset and noticing that pain was interfering with daily activities.

Similarly, Hart (1983) found that JAS (Form T)-defined Type A university students reported fewer symptoms than Type Bs and rated themselves as being in better health than their peers during a period of perceived environmental challenge and demand (namely an examination period). Consistent with Matthews et al.'s (1983) and Hart's (1983) observations, Carver, Degregorio, and Gillis (1981) found that JAS-(Form T)-defined Type A, injured football players fail to recognize the severity of their injuries and exerted themselves closer to their limits during games than did injured Type B players. Carver et al. (1981) found that relative to Type B injured players, their Type A counterparts were rated by their coaches as exerting themselves closer to their limits and as being more willing to put up with pain when confronted by the challenge of game participation. It is interesting to note, however, that no between-types differences in coaches' rating of injured players emerged when subjects were rated with respect to their exertion and willingness to put up with pain during less challenging activities.

In summary then, the studies described above seem to indicate that certain situational characteristics may be important in determining the extent to which Type A subjects report symptoms and take remedial or self-regulatory steps. It would appear that during challenging and/or demanding circumstances, Type A individuals may not become aware of symptoms and/or may fail to recognize the seriousness of symptoms. This is reflected in Type A individuals' symptom under-report both during the period of challenge and in post-task retrospective reports about symptoms experienced during the challenge. It could be argued that this state of affairs is consistent with the notion that while preoccupied with an important or difficult task, Type A individuals may allocate attention to task-relevant aspects of the environment at the expense of task-peripheral stimuli, such as symptoms (see Weidner and Matthews, 1978). Presumably, if one does not attend to symptom stimuli, one cannot report such stimuli or the full intensity of these stimuli during and/or following task performance.

The observation that Type A individuals under-report symptoms during challenging circumstances can also be argued to be consistent with Carver et al.'s (1976) suggestion that when confronted with ongoing challenge and in order to maintain high levels of performance, Type A individuals may not acknowledge symptoms. However, the finding that Type A subjects under-report symptoms retrospectively following completion of a challenging and/or demanding task (see Dembroski et al., 1978; Holmes et al., 1982; Manuck and Garland, 1979; Manuck et al., 1978; Pittner and Houston, 1980) seems to argue against Carver et al.'s (1976) hypothesis, That is, the acknowledgement of symptoms following task performance could no longer be considered a threat to personal control over environmental demands.

Given the role proposed for attention allocation in the symptom under-report exhibited by Type A individuals (see Weidner and Matthews, 1978), it is important to consider the evidence available in support of between-types differences in the allocation of attention. This evidence is reviewed in the next section.

3.1.2 Evidence of between-types differences in the allocation of attention

The view that Type A individuals may under-report symptoms because of their allocation of attention policy has not been systematically researched. Furthermore, the few studies attempting to provide some data on this point have proved inconclusive due to the inadequate choice of experimental paradigms and stimuli employed in these studies. These studies are discussed in the following paragraphs.

In an attempt to investigate between-types differences in attention allocation, Matthews and Brunson (1979) carried out three studies. In their first study, they required JAS (Form T)-defined Type A and Type B university students to work simultaneously for six and a half minutes on a cognitive task and on a simple intermittent reaction time task. Within this dual task paradigm, the cognitive task was assigned primary task status and the reaction time task a secondary status. Task status was manipulated through physical arrangement of task-related material and experimental instructions. Subjects were instructed to respond to the primary cognitive task with their dominant hand and to the secondary reaction time task with their non dominant hand. Furthermore, while instructions for the primary cognitive task were elaborate, were presented first, and included the challenge to work as fast and accurately as possible, the secondary task was presented as an "after thought". It should also be noted that the light to which subjects had to respond as part of the secondary task, was located at approximately 2 o'clock in the subject's right field of vision.

Matthews and Brunson (1979) hypothesized that given their concern with achievement and control, Type A subjects would focus their attention on central aspects of the environment (i.e., the primary task), and thus fail to attend to peripheral aspects (i.e., the secondary task). Analyses of the data revealed that, consistent with the authors' hypothesis, Type A subjects performed significantly worse than Type Bs on the secondary task. Type A subjects were slower to react to the secondary stimuli and noticed fewer presentations of these stimuli than Type Bs. Also consistent with the authors' hypothesis, Type A subjects were found to perform significantly better than Type Bs on the primary task.

Matthews and Brunson (1979) argue that their findings can be taken to reflect the different allocation of attention policy of Type A and Type B individuals in "relatively unstructured settings". Furthermore, they reason that since Type As attend less to peripheral tasks than do Type Bs, Type A individuals may also attend less to task-peripheral stimuli such as symptoms. However, both assumptions should be questioned. It should be noted that the dual task paradigm employed by Matthews and Brunson (1979) can hardly be called an "unstructured setting". That is, in such a paradigm, the importance of primary and secondary task stimuli was clearly defined by physical arrangements and instructions. This observation suggests that Matthews and Brunson's (1979) dual task paradigm failed to measure subjects' ability to incidentally process task-peripheral stimuli. The measurement of such ability is important, if one is to draw any conclusions about subjects' ability to process visceral stimuli. It could be argued that when one attends to an important task during the course of every day activities, peripheral aspects of the environment (such as symptoms) may be perceived incidentally and not as a consequence of being part of a secondary task to which attention has been directed by others. Generally speaking, symptom awareness may be part of incidental learning experiences which may take place depending on the trade off between symptom intensity and the proportion of attention capacity that is engaged in dealing with more pressing aspects of the environment (see Pennebaker, 1982, 1983).

It should also be noted that as a consequence of the relatively awkward location of secondary task-related material, subjects in Matthews and Brunson's (1979) study one, may not have been able to adequately attend to the secondary light stimuli, if they were to also monitor and respond to the primary task. Therefore, it is possible that Matthews and Brunson (1979) may have measured subjects' deliberate decision to visually attend to one source of visual information over another in a situation where it was physically impossible to do both.This weakens the analogy they wish to draw between this experimental situation and subjective symptom experience.

In summary, several aspects of Matthews and Brunson's (1979) study one question its relevance to a description of the role of attention in the symptom report pattern of Type A and Type B individuals. At most, Matthews and Brunson's study one demonstrates that, given sufficient emphasis on the importance of performance in a particular task, Type A subjects concentrate more effort and attention on excelling in that particular task at the expense of less important tasks. This observation is consistent with the view that Type A individuals are achievement oriented. Although this may indirectly indicate that during the performance of an important task, Type A individuals allocate greater proportions of information processing capacity to the task, it remains to be directly demonstrated that this focus of attention may lead Type A individuals to restrict the incidental processing of visceral sensations.

Matthews and Brunson (1979) carried out two further studies in which they attempted to evaluate whether task-peripheral stimuli are "actively" disregarded by Type A individuals or whether the presence or absence of these stimuli is inconsequential to them. In these studies, half of the Type A and Type B subjects were required to perform the Stroop Colour Naming Test (Stroop, 1935) while exposed to distracting sounds. The remaining subjects were required to perform the test without exposure to distracting sounds.

Matthews and Brunson (1979) reasoned that the effect of noise on Stroop task performance provided an attractive avenue for investigating whether Type A individuals "actively" inhibit their attention to distracting task-peripheral stimuli. These researchers observed that members of the general population exposed to distracting sounds during completion of the Stroop Colour Naming Test had been found to perform better on this test than subjects not exposed to such distraction (see Hartley and Adams, 1974). According to Matthews and Brunson (1979) this finding was due to the fact that subjects exposed to distracting sounds actively inhibit their attention to the noise and in doing so, also inhibit their attention to other task irrelevant cues (including the name of the colour of the stimulus word). Based on this finding, Matthews and Brunson (1979) hypothesized that if Type A subjects attend less to task irrelevant information than Type Bs, simply because they attend to central tasks, their performance on the Stroop Colour Naming Test should not be affected by exposure to a noise distractor. Matthews and Brunson (1979) argued that, on the other hand, if Type A individuals actively inhibit their attention to potentially distracting stimuli, their performance on the Stroop Colour Naming Test should be facilitated by exposure to distracting sounds.

Analyses of the data from Matthews and Brunson's (1979) study two revealed that, consistent with the authors' hypothesis, Type A subjects exposed to distracting sounds performed better than Type As not exposed to distracting sounds. It was also observed that while Type A subjects exposed to distracting sounds outperformed their Type B counterparts, no significant between-types differences were evident among subjects not exposed to distracting sounds. However, contrary to the hypothesized facilitating effect of noise on Stroop task performance, Type B subjects showed a tendency to perform more poorly when exposed to noise.

Concerned with the reliability of Type B subjects' responses to distraction, Matthews and Brunson (1979) carried out a third study identical to their study two. In study three, Matthews and Brunson observed the hypothesized facilitating effect of distracting sounds on the Stroop task performance of Type B subjects. However, among Type A subjects, the facilitating effect of distracting sounds on Stroop task performance only approached statistical significance.

Despite the apparent unreliability of their findings, Matthews and Brunson (1979) argue that the results of studies two and three indicate that Type A individuals actively inhibit their attention to task-peripheral stimuli. Furthermore, despite the rather symptom-remote nature of the sound stimuli employed in their studies, Matthews and Brunson (1979) argue that their findings imply that Type A individuals actively inhibit their attention to symptoms. Furthermore, they argue that active inhibition of attention to symptoms may be part of a strategy by which Type A individuals inhibit attention to stimuli perceived to be detrimental to performance in important activities. It should be noted, however, that evidence has been reported by others to indicate that Type A individuals' failure to process task-peripheral stimuli may not be restricted to stimuli which are detrimental to task performance (see Strube, Turner, Patrick, and Perrillo, 1983). The fact that Type A individuals may fail to process task-peripheral stimuli that are not detrimental to task performance suggests that (rather than actively inhibiting attention to task-peripheral stimuli) they may simply be drawn to attend maximally to important aspects of the environment which (within a limited capacity model of attention) has implications for the limited processing of other stimuli.

As in Matthews and Brunson's (1979) study one, Stern, Harris, and Elverum (1981) carried out an investigation of between-types differences in the allocation of attention within a dual task paradigm. Consistent with Matthews and Brunson's (1979) findings, Stern et al. (1981) found that JAS (Form T)-defined Type A university students performed better in whichever task was described as most important by instructions and physical arrangements of task material. Given their use of a dual task paradigm, in which tasks were clearly defined as important or trivial, Stern et al.'s (1981) study is subject to the same criticisms levelled at Matthews and Brunson's (1979) study one. The fact that one of the tasks employed by Stern et al. (1981) involved the recall of mood labels seems to add little in terms of directly evaluating the association between the symptom report pattern of Type A individuals and attention focus.

3.1.3 The role of attention allocation in symptom awareness

Although there has been no direct or systematic evaluation of the role of attention in Type A subjects' symptom under-report, the assumption that attentional processes may underlie this phenomenon is intuitively appealing. Given their job involved and hard driving nature, Type A individuals (when confronted with challenging and/or demanding activities) may focus attention and concentrate information processing capacity on task-relevant aspects of the environment at the expense of task-peripheral stimuli such as symptoms. This hypothesis becomes even more plausible, if one considers the evidence suggesting that attention-related processes play an important role in symptom awareness. The theoretical issues and experimental evidence related to this proposition are considered in the following paragraphs.

The concept of limited attention capacity (see Easterbrook, 1959; Kahneman, 1973; Navon and Gopher, 1973) assumes that the level of attention that can be devoted to stimuli is finite. Also relevant to the present discussion is the observation that a discriminable property of attention is its distribution. Thus attention may be allocated to a number of different stimuli in the environment or may be concentrated on a single particular stimulus (see Scheier, Carver, and Matthews, 1983). Another discriminable property of attention is its directive nature. In other words, attention can be allocated almost completely to certain stimuli with little being allocated to other stimuli which are in turn processed more superficially (see Broadbent, 1958; Norman, 1968; Treisman, 1969).

Various researchers have suggested that the processing of internal visceral sensations is no less a perceptual experience than hearing or vision (see Brener, 1977; Pennebaker, 1982, 1983; Sadler and Tesser, 1973; Scheier et al., 1983). In fact research has indicated that attention to one's body has similar effects to the focussing of attention on external stimuli. That is to say, the more an individual pays attention to internal stimuli, the more extensive and accurate the processing of such information becomes (see Duncan and Lair, 1980; Gibbons, Carver, Scheier and Hormuth, 1979; Miller, Murphy, and Buss, 1981; Pennebaker, 1982, Pennebaker and Lightner, 1980; Sadler and Tesser, 1973; Scheier, Carver, and Gibbons, 1979). However, within a limited capacity model of attention, the focussing of attention on external aspects of the environment is said to restrict the processing of internal stimuli. Pennebaker (1982, 1983), for example, has suggested that the processing of internal stimuli is inversely related to the novelty, salience, complexity, and/or importance of any external stimuli competing for processing. Furthermore, Pennebaker (1982, 1983) argues that active involvement in an important, interesting, complex and/or demanding activity, makes it less likely that the individual will process bodily sensations. Pennebaker (1982, 1983) points out that, on the other hand, if the individual is in a boring and/or undemanding environment, the lack of competing stimuli would permit processing of physical sensations.

Circumstantial support for Pennebaker's (1982, 1983) notion can be found in survey studies, in which persons living in social isolation have been noted to report more physical symptoms (see Mechanic, 1972; Moos and Van Dort, 1977), consume more medication (see United States National Center for Health Statistics, 1979), and rate themselves as being in worse health than those residing with other persons. Similarly, individuals in undemanding work environments have been found to seek medical attention more frequently (see Moos, 1975) and report more physical and emotional distress symptoms (see Coburn, 1975; Harrison, 1976; Weiman, 1977; Wright, Kane, Olsen, and Smith, 1977) than persons who rate their jobs as demanding and/or interesting. More importantly, experimental research has demonstrated that the novelty and complexity inherent in external stimuli available for processing is negatively associated with the number and intensity of reported symptoms and positively associated with endurance of pain and fatigue (see Kotz, Rodionov, Sitnikov, Tkhorevsky, and Vinogradova, 1978; Pennebaker, 1980; Pennebaker and Brittingham, 1979; Pennebaker and Lightner, 1980). These observation suggest that within a limited capacity model of attention, the taxing of attention capacity by complex, important, and novel aspects of the external environment, may be associated with limited processing of internal stimuli, leading to an elevated threshold for noticing symptoms, and an elevated tolerance of exertion.

3.1.4 Rationale for further research

Although evidence has been reported in support of the notion that Type A individuals may under-report symptoms, no systematic or direct investigation of the processes underlying such a phenomenon has been reported in the literature. The hypothesis which has received most attention concerns the mechanisms by which those with the TABP direct their attention to task-relevant information (or divert it away from task-peripheral information) in both their internal and external environments. However, the nature of these mechanisms is yet to be elucidated. On the one hand, Type As have been shown to direct their attention maximally to tasks nominated as important, to the detriment of secondary tasks nominated as less important. On the other hand, Type A individuals have been shown to under-report physical and emotional distress symptoms. The problems outlined in this chapter arise from the assumption that the former is a direct analogy of the latter.

As yet no study has investigated directly, within the same experimental design, whether the incidental symptom awareness of Type A individuals varies as a function of attentional priorities to task-relevant and task-peripheral information. Furthermore, studies which have investigated the attention allocation policy of Type A and Type B individuals during challenging conditions have done so using external stimuli considerably removed from the experience of visceral sensations and within experimental paradigms which have not assessed subjects' ability to incidentally process task-peripheral information. Moreover, where data have been accumulated, subject samples have typically involved undergraduate university students, including females, who are not at all representative of employed, middle aged males for whom the incidence of CHD is greatest (see Johnson, 1977) and for whom the association between Type A behaviour and CHD has been best established (see Chapter 2 - Section 2.1).

The research studies reported in the following chapters were designed to attempt to elucidate the processes underlying the alleged under-report of symptoms by Type A individuals. This was not restricted to the investigation of the hypothesis emphasizing an attention focus explanation, but instead involved a systematic evaluation of the merits of various hypotheses which appear to be suggested by the literature as likely explanations of Type A subjects' symptom under-report. The first investigation to be reported in this thesis was designed, among other objectives, to ascertain whether previous findings of Type A subjects' symptom under-report could be replicated in a population of employed adult men. This was judged necessary given the almost complete reliance of previous studies on university student subjects.

CHAPTER 4

4.1 Introduction: Study 1

As noted in Chapter 3 (Section 3.1.1), a number of studies have indicated that Type A individuals tend to report relatively fewer and less intense physical and emotional distress symptoms than Type B individuals (see Carver et al., 1976; Dembronski et al., 1978; Hart, 1983; Holmes et al., 1982; Malcom et al., 1984; Manuck and Garland, 1979; Manuck et al., 1978; Pittner and Houston, 1980; Schlegel et al., 1980; Swan et al., 1986; Weidner and Matthews, 1978). Particularly interesting is the observation that Type A individuals fail to report the greater physiological reactivity and effort expenditure which they exhibit during periods of challenge and environmental demand (see Carver et al., 1976; Holmes et al., 1982; Malcom et al., 1984; Manuck and Garland, 1979; Manuck et al., 1978; Pittner and Houston, 1980). Despite the important implications which understanding of this phenomenon may have (see Chapter 3), little systematic research has been carried out to elucidate the mechanisms that elicit it.

Within the limited literature in the area, the two most frequently cited hypotheses are those proposed by Carver et al. (1976) and Matthews and her colleagues (see Matthews and Brunson, 1979; Weidner and Matthews, 1978). As would be recalled Carver et al. (1976) proposed that Type A individuals' symptom under-report may be part of a strategy to safeguard personal control over challenging environmental circumstances. Specifically, Carver et al's. (1976) argued that while confronted with ongoing challenge or threat, Type A individuals "suppress" symptoms. The term "suppression" was vaguely explained by Carver et al. (1976) as the opposite of "acknowledgement". Other researchers' interpretation of Carver et al.'s (1976) use of the term "suppression" appears to have involved the concept of denial of symptoms during challenging or threatening circumstances, and the ability to retrospectively report these symptoms upon withdrawal of the source of threat or challenge (see Weidner and Matthews, 1978). This interpretation of symptom under-report implies that during task performance Type A subjects may be aware of symptoms but choose not to report them. If this is the case, it is not clear how useful this strategy may be in aiding Type A individuals to protect performance from symptom-induced deterioration. Furthermore, as noted in Chapter 3, various studies have found that upon completion of challenging and/or demanding tasks, Type A individuals may be unable to retrospectively report symptoms which have occurred during task performance. This observation tends to argue against the notion that Type A individuals may deny symptoms during task-performance but may be able to retrospectively report them following it.

Matthews and her colleagues (Matthews and Brunson, 1979; Weidner and Matthews, 1978), on the other hand, proposed that Type A individuals' symptom under-report could be explained by the attention allocation policy of these individuals. Originally, Weidner and Matthews (1978) argued that during challenging and/or demanding circumstances, Type A individuals allocate a greater proportion of attention capacity than do Type Bs to task-relevant aspects of the environment, at the expense of task-peripheral stimuli, such as symptoms. However, in a subsequent series of studies, Matthews and Brunson (1979) appeared to alter their argument and suggested that Type A individuals may actively inhibit their attention to task-peripheral stimuli (including symptoms) which may be considered detrimental to task performance.

As noted in Chapter 3, there are both methodological and conceptual difficulties with Weidner and Matthews' (1978) and Matthews and Brunson's (1979) explanations of Type A subjects' symptom under-report. These difficulties stem from: (a) the apparent inability of an attention focus explanation to account for Weidner and Matthew's (1978) findings (see Chapter 3 - Section 3.1.1); (b) the use of dual task paradigms which do not permit the evaluation of subjects' ability to incidentally process task-peripheral stimuli (see Matthews and Brunson, 1979; Stern et al., 1981); (c) the use of task-peripheral stimuli which appear to be far removed from the experience of symptoms (see Matthews and Brunson, 1979; Stern et al., 1981); (d) the unreliability of experimental paradigms supposedly measuring active inhibition of task-peripheral stimuli (see Matthews and Brunson, 1979); and (e) the observation that Type A individuals' failure to process task peripheral stimuli may not be restricted to task-peripheral stimuli that are detrimental to task performance (see Strube et al., 1983).

Research in the area of between-types differences in attention allocation has only indicated that Type A subjects tend to direct their attention to predesignated tasks of importance, to the detriment of tasks or stimuli given less importance by experimental instructions (see Matthews and Brunson, 1979; Stern et al., 1981). This does not constitute direct evidence that allocation of attention strategies are responsible for Type A individuals' under-report of symptoms. As yet no study has investigated the association between Type A subjects' symptom report and their allocation of attention to task-relevant and task-peripheral stimuli within the same experimental design. Furthermore, where data have been collected, subject samples have typically involved undergraduate university students, including females. Obviously, these subjects are not at all representative of employed adult males for whom the incidence of CHD is the greatest (e.g., Johnson, 1977) and for whom the association between Type A behaviour and CHD has been more firmly established (e.g., Rosenman et al., 1964).

4.1.1 Objectives of Study 1

4.1.1.1 Replication of previous findings

The first study reported in this thesis (i.e., Study 1) was designed to address some of the issues listed above. Firstly, it was judged necessary to attempt to replicate previous findings of Type A subjects' symptom under-report in a sample of employed adult males. Such replication was considered an important prerequisite, since little research on the symptom report pattern of such individuals had been carried out. Furthermore, given that the association between the TABP and CHD has been better established in populations of employed adult males (e.g., Rosenman et al., 1964), the replication of symptom under-report in this population was considered to facilitate the drawing of conclusions about the risk for CHD which symptom under-report may imply.

4.1.1.2 Evaluation of the 'attention focus' explanation of Type A subjects' symptom under-report

Study 1 also sought to evaluate the merits of the attention focus explanation (see Matthews and Brunson, 1979; Weidner and Matthews, 1978) of Type A subjects' symptom under-report. Specifically, it was attempted to ascertain whether the symptom report of Type A individuals was associated with restricted incidental processing of other task-peripheral stimuli, and whether the extent to which Type A subjects incidentally processed task-peripheral stimuli (including symptoms) varied as a consequence of the extent to which these subjects attended to task-relevant stimuli. Therefore, Study 1 included measures of attention to task-peripheral stimuli (other than symptoms) as well as to task-relevant stimuli. It was reasoned that the inclusion of these measures would facilitate evaluation of the extent to which, during challenging circumstances, the symptom report of Type A individuals is determined by restricted processing of task-peripheral stimuli and by concentration of attention capacity on important aspects of the environment.

It is important to note that, contrary to previously published studies, processing of task-peripheral stimuli in Study 1 of this thesis was not described as a secondary task. In fact subjects were not forewarned as to the possible presence of such stimuli during task performance. This procedure was considered to represent a better test of subjects' ability to incidentally process visceral (internal) stimuli than the dual task paradigms used by previous researchers (see Matthews and Brunson, 1979; Stern et al., 1981). After all, it is not often that in the course of every day activities, individuals are specifically asked to treat symptom perception or symptom report as a primary or secondary task, or are forewarned to attend to symptoms. As noted earlier (see Chapter 3 - Section 3.1.3), there is evidence to suggest that the processing of visceral sensations may be an incidental learning experience, the likelihood of which may be inversely related to the complexity, importance, and novelty of competing external stimuli (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980). In other words, the processing of symptoms may depend on the availability of spare capacity to process visceral stimuli, after more pressing aspects of the environment have been given priority.

4.1.1.3 Evaluation of the symptom "suppression" explanation of Type A subjects' symptom under-report

Study 1 also included a manipulation of expected task duration similar to that carried out by Weidner and Matthews (1978). This manipulation was included so as to facilitate the evaluation of the "suppression" hypothesis originally formulated by Carver et al., (1976) and later evaluated in a group of female undergraduate students by Weidner and Matthews (1978). As mentioned earlier (see Chapter 3 - Section 3.1.1), this hypothesis predicts that while confronted with challenging or threatening circumstances Type A subjects may deny or fail to acknowledge symptoms, but are still able to retrospectively report these symptoms following the withdrawal of the source of challenge or threat. Theoretically, the object of this symptom denial may be to ensure continued high levels of performance and thus personal control over important environmental circumstances (see Carver et al., 1976; Weidner and Matthews, 1978).

As will be recalled (see Chapter 3 - Section 3.1.1), having manipulated subjects' expectations regarding task duration in a sample of female undergraduate university students, Weidner and Matthews (1978) found inconclusive support for the notion that Type A subjects may deny symptoms in order to protect performance from symptom induced deterioration. On the one hand, they found that Type A subjects confronted with ongoing challenge under-reported symptoms. On the other hand, however, Type A subjects confronted with ongoing challenge did not appear to deny symptom-induced disruption on task performance.

Given the inconclusive nature of Weidner and Matthews' (1978) findings and the characteristics of their subject population, it was decided to evaluate the extent to which the symptom report pattern of Type A employed adult males could be affected by varying expectations of task duration.

4.1.2 Hypotheses

4.1.2.1 Hypotheses concerning the replicability of previous findings

(1) Based on previous research (see Chapter 2 - Section 2.2.3), it was hypothesized that during an ego challenging or threatening cognitive-motor task, Type A subjects would experience greater elevations in cardiovascular arousal (from baseline) than their Type B counterparts.

(2) Also based on previous findings (see Chapter 3 - Section 3.1.1), it was hypothesized that following performance in the ego challenging or threatening task described above, Type A individuals would retrospectively report fewer and less intense symptoms of physical and emotional distress (for the task period) than Type Bs.

4.1.2.2 Hypotheses concerning the evaluation of the 'attention focus' explanation

(3) It was hypothesized that, if Type A subjects' symptom under-report was mediated by their greater allocation of attention capacity to task-relevant aspects of the environment, they should be able to recall more of those stimuli following task completion than Type Bs.

(4) Furthermore, based on the assumptions of the limited capacity model of attention (see Chapter 3 - Section 3.1.3), it was hypothesized that if Type As allocated a greater proportion of attention capacity to task-relevant stimuli, this would be at the expense of task-peripheral stimuli. Therefore, Type A subjects should not only report fewer and less intense (task-peripheral) symptoms for the task period, but they should also do less well than Type Bs in a post-task recognition test of other task-peripheral stimuli present during task performance.

4.1.2.3 Hypotheses concerning the evaluation of the symptom "suppression" explanation

(5) Based on Weidner and Matthews' (1978) interpretation of Carver et al.'s (1976) "suppression" hypothesis, it was hypothesized that if Type A subjects' symptom under-report was attributable to denial in order to ensure high levels of task performance, Type A subjects should only exhibit symptom under-report when confronted with the ongoing challenge of task performance and not after completion of a challenging task.

4.1.3 Method

4.1.3.1 Overview and design

Subjects in Study 1 were required to perform a cognitive-motor task under challenging conditions and to make post-task retrospective ratings of symptoms which occurred during task performance. Following Weidner and Matthews' (1978) manipulation of expected task duration, half of the subjects in Study 1 were led to believe that they would be working on the cognitive-motor task for two minutes, while the remaining subjects expected to work for 4 minutes. In reality all subjects were stopped after two minutes and symptoms were rated then. A post-task recall test of task-relevant stimuli, as well as a post-task recognition test of task-peripheral stimuli presented during task performance were also administered. Subjects' heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured before and during task performance.

Upon completion of all measures related to Study 1, all subjects took part in a second study designed to test for possible between-types differences in subjects' dispositional ability to perceive visceral stimuli. The method and results of this second study are described later in this chapter.

4.1.3.2 Subjects: their recruitment and characteristics

Given that the association between the TABP and CHD has been best established in populations of adult male white collar workers (see Rosenman et al., 1964), the studies reported in this thesis sought to recruit subjects with those characteristics. The best source of adult male white collar workers in Canberra is the various departments of the Australian Public Service which have their headquarters in this city.

Subjects taking part in Study 1 were recruited from among a group of 83 adult males, engaged in full-time administrative positions in the Australian Public Service, who volunteered to participate in psychological research and who returned scorable JAS (Form C) protocols. This group of subjects responded to the author's first recruitment drive for male subjects, aged between 20 and 60 years, working full-time in the Australian Public Service. Recruitment of potential subjects was carried out by placing pamphlets on the information boards of different public service buildings and by delivering pamphlets inside these buildings.

It should be noted that at the time of recruitment, clerical and administrative positions in the Australian Public Service were divided into four divisions. Division Four consisted of junior personnel, performing typing and office assistance duties. Divisions Two and Three consisted of administrative and managerial personnel, who generally speaking (but not exclusively) gained entrance to the public service on the basis of university qualifications. Division Three was composed of 11 levels, with those in levels 9 to 11 usually occupying positions as section managers, branch assistant directors, and branch directors. Division Two of the service was divided into four levels, which represented different degrees of seniority in positions as general assistant directors. Persons in Division One of the service are usually (but not exclusively) political appointees.

Although no specific mention of seniority was made in pamphlets asking for volunteers, persons who volunteered to participate in the present study were all from Divisions Two and Three of the Australian Public Service. This may have been related to the method of recruitment. Specifically, many pamphlets were left on desks and individual offices which are only occupied by employees in Divisions Two and Three. The lack of volunteers from the Division Four of the service may have also been related to the fact that this division is largely made up of female employees.

Potential subjects were informed that in exchange for participation in experiments "designed to investigate the effect of fitness on the performance of cognitive tasks" they would receive a measure of their estimated aerobic capacity and percentage body fat. It was thought necessary to keep from subjects the true nature of the research, so as not to affect naturally occurring patterns of attention allocation and symptom report. The need to attract non student subjects for participation in experimental research also made it important that potential subjects be offered some form of reward for their inconvenience. After consultation with other researchers, it was decided that the investigation of the relationship between fitness levels and cognitive task performance was a sufficiently credible research aim and that measures of aerobic capacity and percentage body fat could be used to entice non student subjects to participate in research. Therefore although in Studies 1 and 2 measures of aerobic capacity and percentage body fat were not directly relevant to the issues under investigation, subjects selected for participation underwent procedures (at the completion of Study 2) which were used to estimate percentage body fat and aerobic capacity.

Potential subjects contacted the experimenter by telephone, who then arranged for copies of the JAS (Form C) and other questionnaire measures (which are discussed in Chapter 5) to be sent to them. These individuals were instructed to complete all questionnaires as soon as possible and to return them to the experimenter in a stamped and addressed envelope provided for this purpose. On receipt of the completed questionnaires, the experimenter telephoned the subjects and arranged a suitable time for them to attend a laboratory located on the campus of the Australian National University.

Subjects' behaviour type was assessed with the Type A subscale of Form C of the JAS (Jenkins et al., 1979). This instrument was described earlier in Chapter 1 (a copy of this instrument can be found in Appendix A.1). Only subjects exhibiting relatively extreme Type A scores were selected for participation in Study 1. Specifically, subjects were classified as Type A or Type B according to whether their JAS Type A scores were above one half of one standard deviation or below one half of one standard deviation respectively, from the volunteer population mean. This selection procedure was adopted in an attempt to address the observed lack of confidence in the discriminate ability of the JAS in cases where Type A scores are in the border zone between Type A and Type B behaviour (see Jenkins et al., 1979).

As can be appreciated from Table 4.1, the mean JAS Type A raw score for all 83 volunteers was 228.53 (SD = 67.52). From these 83 volunteers, 44 subjects (22 Type As and 22 Type Bs) were classified as Type A or Type B using the procedure described above. As Table 4.1 illustrates, the 44 extreme scorers who took part in Study 1 had a mean age of 34.33 years (SD = 7.54). The mean age for the selected Type A subjects was 34.08 years (SD = 6.61), while the mean age for selected Type B subjects was 34.58 years (SD = 8.53). The difference between these means was not statistically significant, $t(42) = 0.22$, $p = .831$.

Table 4.1 presents mean scores and standard deviations for all JAS subscales and for age, for both the volunteer population and the group selected for participation in Study 1. As evidenced in this table, the fact that the subjects selected for participation were extreme scorers on the Type A subscale of the JAS affected the nature of the distribution of scores on that scale. Specifically, while the Type A subscale mean scores for the total volunteer population and the sample selected for participation were relatively similar, the latter exhibited a relatively greater standard deviation (80.96) compared to the former (67.52). This was also the case for the distribution of scores on the Job Involvement subscale (see Table 4.1). Neither the distribution of scores on the Speed and Impatience and Hard-Driving and Competitive subscales of the JAS, nor the distribution of age appeared to be affected by the selection of extreme Type A subscale scorers (see Table 4.1).

It is interesting to note that the manner in which volunteers were recruited into the potential subject population, being offered a measure of aerobic capacity, did not appear to have affected the distribution of Type A characteristics among those who responded to this recruitment strategy. Support for this notion comes from a study by Byrne and Reinhart (1989). These researchers also recruited Australian Public Service white collar employees for participation in a survey study of work characteristics and achievement striving. In contrast to the recruitment strategy employed in the present study, Byrne and Reinhart (1989) recruited their subjects through the Public Service Board, a body which encouraged subjects to participate, but which did not coerce or reward them for doing so. Furthermore, Byrne and Reinhart (1989) did not require subjects to attend a laboratory, but simply to anonymously complete questionnaire measures at their home or place of work. Byrne and Reinhart (1989) report a mean JAS Type A subscale score of 233.68 and a standard deviation of 66.85 for a sample of 432 public servants in administrative positions (84.8% of whom were male). These figures correspond very closely with the ones obtained for subjects in the present study. This observation tends to support the notion that the recruitment strategy used in the present research did not cause Australian public servants with certain Type A or Type B characteristics to be more likely to volunteer than would otherwise have been the case.

Table 4.1
Means and standard deviations for age and the four subscales of the Form C of the JAS for the total volunteer population and the selected subject sample

	Total Volunteer Population				Selected Sample		
	Mean	SD	Range	N	Mean	SD	N
JAS (Form C) Subscales							
Type A	228.25	67.52	74 - 383	83	225.68	80.96	44
Speed & Impatience	177.60	62.58	42 - 306	83	177.96	60.89	44
Hard-Driving & Comp.	107.81	24.58	67 - 171	83	105.16	24.11	44
Job Involvement	228.64	46.42	121 - 313	83	234.50	51.23	44
Age							
Years	33.16	7.50	25 - 58	83	34.33	7.54	44

It is also interesting to point out that the volunteer population mean of 228.25 (which represents a standard score of approximately 0.2) and the standard deviation of 67.52 (which represents a standard score of approximately 8.6) are very similar to the respective figures for the entire WCGS population on which the JAS was standardized. The raw mean score for the WCGS population was 227 (which was transformed to a standard score of 0.0) with a standard deviation of 78 (which represents a standard deviation of 10 in standard terms - see Jenkins et al., 1979). Such observation suggests that as a group, the individuals who volunteered to participate in the present research exhibited a similar distribution of Type A characteristics as the WCGS population on which the JAS was standardized. This in turn promotes confidence on subjects' behaviour type classification.

It should be noted that the exclusion of female subjects from the studies reported in this thesis was based on the consideration of various factors. Firstly, it was reasoned that differences between male and female subjects in symptom report might confound the investigation of the processes underlying between-types differences in symptom report. Mechanic (1972), for example, suggests that differences between the sexes in socialization experiences may explain why males, compared to females, seek less medical care, are less expressive about illness, and appear to be more stoical about symptoms and illness. More importantly, differences have also been found in the extent to which males and females develop the ability to perceive visceral sensations (see Katkin, 1985). Secondly, the exclusion of female subjects was also related to the fact that the JAS (which was the measure of Type A behaviour employed in the studies reported in this thesis), although developed for use with employed adults of both sexes, had only been standardized on the male participants of the WCGS and has not been standardized on adequate samples of females using the SI as the criterion for validity.

Finally, it should be noted that the recruitment of subjects between the ages of 20 and 60 years in white collar occupations was an attempt to adhere to the suggestion by Jenkins et al.(1979) that the JAS should be used with employed persons between the ages of 25 and 65 and that the content of the JAS makes it unsuitable for administration to those persons not engaged in full-time employment. In order to obtain sufficient numbers of volunteers, it was thought necessary to lower the minimum age of 25 years which had been suggested by Jenkins et al. (1979). As it turns out, however, the minimum age of volunteers in the first recruitment drive was 25.055 years (see Table 4.1). The maximum recommended age was also lowered as a cautionary step because in later studies subjects were required to perform tasks involving strenuous physical exercise.

4.1.3.3 Materials and apparatus

The material employed in Study 1 was an extended and modified version of the Digit Symbol Substitution (DSS) subtest of the WAIS (Wechsler, 1955). The top half of the DSS test sheet contained the standard nine items, made up of numbers 1 to 9 and their respective symbols, but a five letter word was placed immediately above and below each of the nine number and symbol pairs. These words were selected from Gilhooly and Hay's (1977) ratings of familiarity. Words selected for inclusion in the DSS task sheet had a familiarity rating of between 3 and 5 on a 7-point scale. In the bottom half of the DSS task sheet there were a total of eight rows of 25 numbers each. These numbers ranged from 1 to 9. During task performance, subjects were required to encode each number (i.e., match with the respective symbol) by writing the appropriate symbol in a box below each digit. The physical proximity of the task-relevant number-symbol pairs to the task-peripheral words was an attempt to ensure that it was not physically impossible to process both types of stimuli at any one time, as may have been the case in previous studies of between-types differences in attention allocation (see Matthews and Brunson, 1979 and Chapter 3 - Section 3.1.2). A copy of the extended and modified DSS task sheet containing the word stimuli can be found in Appendix A.3.

Subjects' pre-task familiarization with the DSS task took place on a separate training sheet. This training sheet contained the nine number-symbol pairs and one row of 25 numbers, which subjects used to practice the encoding of numbers before commencement of the actual test session. This training sheet did not contain any word stimuli. A copy of this DSS training sheet is presented in Appendix A.2.

Before and during the DSS task, HR was measured with plate electrodes attached to the subject's chest and was recorded using a Grass polygraph. Blood pressure (BP) was measured using a Copal digital sphygmomanometer.

4.1.3.4 Procedure

All subjects were tested individually in a sound-deadened and temperature controlled laboratory. Temperature was kept between 20 and 22°C. The laboratory, and in particular the table in front of the subjects, were well illuminated.

Upon arrival at the laboratory, subjects were required to sit on a standard office chair placed in front of a table, and asked to "relax" for five minutes so as to allow physiological responses to approach resting levels. It should be noted that the "Publication Guidelines for Heart Rate Studies in Men" (Jennings et al., 1981) stress the need for a resting period environment in which external stimuli are minimized, but makes no recommendations regarding the length of time that should be allowed for subjects to acclimatize to the laboratory setting. The five minute rest (acclimatization) period was arrived at by considering previous research in the Type A area. At the end of this period, electrodes were attached to the subject's chest and a blood pressure cuff was placed on the subject's non dominant arm. A five minute baseline period was then commenced, during which HR was continuously recorded. Measures of SBP and DBP were taken at the end of this time.

Subjects were then asked to complete the State Form of the State-Trait Anxiety Inventory (STAI - Spielberger, Gorsuch, and Lushene, 1970) and instructed that their ratings should reflect how they were feeling at that moment (see Appendix A.4). Subjects were also asked to complete a pre-task measure of self-perceived present health status. This was done on a 7-point scale in which one represented "poor physical health" and seven represented "good physical health" (see Appendix A.7). This pre-task rating of self-perceived present health was intended as a check for possible differences in health status that may influence the experience of physical symptoms during task performance.

Once subjects had completed all pre-task self-report measures, they were informed that the next phase involved "doing a test commonly used by psychologists to measure intelligence". These instructions were intended to challenge Type A individuals. Previous research had shown that instructions which emphasize the possible evaluation of subjects' abilities and performance tend to elicit the TABP and its accompanying physiological hyper-responsiveness (see Dembroski, MacDougall, Herd, et al., 1979; Goldband, 1980; Holmes et al., 1982; Lulofs et al., 1986; Malcom et al., 1984; Pittner and Houston, 1980). This was particularly important because in the present study it was desirable to elicit Type A behaviour and heightened physiological arousal from susceptible individuals. Specifically, elevations in physiological arousal would serve to test subjects' awareness of this physical state. Furthermore, previous research had indicated a tendency for Type A subjects to under-report symptoms during challenging and/or demanding circumstances (see Chapter 3 - Section 3.1.1).

Following the administration of the challenging instructions described above, subjects were presented with the DSS training sheet (see Appendix A.2) and were allowed to practice by matching six of the numbers with their respective symbols. This practice sheet was then withdrawn and the DSS test sheet (see Appendix A.3) was placed face down on the table in front of the subject. This procedure meant that subjects had no early access to task-peripheral words on the test sheet. In fact the experimenter never mentioned the presence of word stimuli on the test sheet. This ensured that any post-task recognition of such words could be more easily attributed to the incidental processing of these task-peripheral stimuli. Such situation was considered to be more closely related to the incidental detection of physical sensations than previous experimental situations in which subjects had been specifically called to perform a secondary task (see Matthews and Brunson, 1979; Stern et al., 1981).

Before commencing work on the DSS task, subjects were informed that they would be working on the "intelligence test" for two or four minutes, depending on the condition of expected task duration to which the subject had been allocated. Of the 22 Type A and 22 Type B subjects, half were allocated to the Two-Minute Expected Task Duration Condition, while the remainder were allocated to the Four-Minute Expected Task Duration Condition.

Subjects were then reminded that accurate assessment of their "ability level" required that they "try to do as many of the coding items as possible as accurately as possible". Finally, subjects were asked not to start working, nor to turn the DSS test sheet over until the experimenter signalled to do so through the presentation of a soft tone. Subjects were also informed that a second presentation of the soft tone was to signal that time was up and they should stop working.

Before leaving the testing room, the experimenter checked that the electrodes and the blood pressure cuff were securely attached. The experimenter then proceeded to an adjacent room where the polygraph and BP apparatus were placed. In this room there was also a battery operated soft noise apparatus which was used to signal the subject to commence working. During task performance HR was continuously recorded while one blood pressure reading was taken during the 40 second period beginning one minute into the task. After two minutes the experimenter signalled the subject to stop working. On return to the testing room, and in order to lead the Four-Minute Condition subjects to believe that they would have to keep working, the experimenter informed these subjects that they would be required to complete a series of questionnaires and then proceed to work for a further two minutes on the "intelligence test". On the other hand, Two-Minute Condition subjects were told that their participation in the "intelligence test" had been completed and were then asked to complete the same series of questionnaires as their Four-Minute Condition counterparts.

Post-task measures of self-reported symptoms included the State Form of the STAI, which was administered with modified instructions to indicate how they were feeling while doing the test (for Two-Minute Condition subjects) or during the first part of the test (for Four-Minute Condition subjects). The post-task State form of the STAI with instructions for Two and Four-Minute Condition subjects can be found in Appendices A.5 and A.6. Subjects were also asked to complete a 14-item symptom checklist designed by Pennebaker, Burnam, Schaeffer, and Harper (1977) and later used by Weidner and Matthews (1979). This symptom checklist was headed with instructions asking subjects to rate the extent to which they had experienced each of 14 symptoms while doing the "intelligence test" (for Two-Minute Condition subjects - see Appendix A.8) or while doing the "first part of the 'intelligence test" (for Four-Minute Condition subjects - see Appendix A.9). Each item was rated on a 7-point scale, on which 1 represented no symptom and 7 represented severe symptom. Therefore, subjects were asked to rate whether a symptom was present or absent and, if present, to rate the strength or intensity of that symptom. The symptoms rated by subjects were headache, racing heart, itch, shortness of breath, ringing ears, upset stomach, congested nose, sweaty hands, watery eyes, chest pains, stiff muscles, flushed face, dizziness, and cold hands.

As noted above, the experience of symptoms and elevations in state anxiety during task performance were assessed with post-task retrospective ratings. Evidence has been reported that subjects appear to be quite capable of providing sensible ratings on a retrospective basis (see Mackay, 1980).

Upon completion of the self-report measures, subjects were tested for attention to task-relevant information. Specifically, they were required to recall the DSS task symbols for numbers 1 to 9. This was done by providing subjects with a sheet containing the numbers but not the symbols (see Appendix A.12). Attention to task-peripheral word stimuli was tested by presenting subjects with a list of 36 five letter words, 18 of which had been previously presented on the DSS test sheet. Both "new" and previously presented words were taken from Gilhooly and Hay's (1977) ratings of familiarity and had a familiarity rating of between 3 and 5 on a 7-point scale. Subjects were asked to 'tick' each word they thought they could recognize as having been previously presented. Furthermore, for each word 'ticked', subjects were asked to rate on a 5-point scale how confident they were about their judgement. The 36 task-peripheral words, their familiarity ratings, and the confidence rating scale can be found in Appendices A.10 and A.11.

Once all measures had been completed, subjects in the Two-Minute Condition were asked to rest for 10 minutes awaiting the initiation of Study 2. On the other hand, in order to avoid undue suspicion of procedures in Study 2, subjects in the Four-Minute Condition were allowed to continue working on the DSS task for a further two minutes before being asked to rest. The experimental procedures involved in Study 2 are described later in this chapter.

4.1.4 Results

4.1.4.1 Physiological Measures

Baseline HR was obtained for each subject by calculating the mean HR for the last two minutes of the five minute baseline period. Measures of HR, SBP, and DBP for the baseline period were analyzed by 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analyses of variance. These analyses did not reveal any significant main effects or interactions. This means that prior to performance in the DSS task and the administration of challenging instructions, no significant between-types differences in physiological arousal were observed. The complete analysis of variance tables for baseline measures of physiological arousal can be found in Appendices A.13 to A.15.

Table 4.2

Mean HR, SBP, and DBP for Type A and Type B subjects in the Two-Minute and Four-Minute Expected Task Duration Conditions during baseline and task periods (baseline-task period change scores are also included)

	HR (bpm)			SBP (mmHg)			DBP (mmHg)		
	Base-line	Task	Change score	Base-line	Task	Change score	Base-line	Task	Change score
Type A group									
Two-Minute	67.41	81.38	13.97	122.91	129.46	6.55	77.18	78.73	1.55
	(12.35)	(18.69)	(9.75)	(16.99)	(16.75)	(10.91)	(12.69)	(12.22)	(5.16)
Four-Minute	67.70	80.82	13.12	121.09	124.82	3.73	77.27	77.64	0.36
	(10.61)	(13.07)	(5.28)	(15.57)	(11.31)	(8.66)	(13.51)	(11.16)	(4.08)
Total Type A	67.55	81.10	13.54	122.00	127.14	5.14	77.23	78.18	0.95
	(11.23)	(15.74)	(5.04)	(15.93)	(14.15)	(9.72)	(12.79)	(11.43)	(4.58)
Type B Group									
Two-Minute	68.91	77.10	8.19	117.09	117.18	0.09	76.91	76.18	-0.73
	(12.89)	(13.90)	(4.43)	(7.80)	(6.47)	(4.86)	(5.61)	(7.04)	(3.41)
Four-Minute	69.28	79.41	10.13	124.64	126.46	1.82	83.46	84.64	1.18
	(9.46)	(13.31)	(6.90)	(12.24)	(13.06)	(6.58)	(9.71)	(8.79)	(6.23)
Total Type B	69.09	78.25	9.16	120.86	121.82	0.95	80.18	80.41	0.23
	(11.03)	(13.33)	(5.74)	(10.74)	(11.17)	(5.72)	(8.43)	(8.89)	(4.99)

Note: HR change scores were computed for each subject by taking the mean HR for the baseline period away from the mean HR recorded during task performance. Standard deviations are presented in brackets. Total N = 44. For each behaviour type group N = 22. For each type-condition cell n = 11.

As noted earlier, HR was recorded continuously for the two minutes of DSS task performance. The mean HR for the task period was calculated from these data. Measures of HR, SBP, and DBP for the task period were analyzed by 2 (Types: A/B) x 2

(Conditions: Two/Four-minute) covariance analyses with baseline measures as covariates. Analyses of covariance were employed as a way of controlling for non significant differences in baseline levels of physiological arousal, which may have affected the interpretation of between-types differences in physiological reactivity during task performance. For a discussion of the advantages of covariance analysis in addressing issues concerning the law of initial values or the biasing effect of non significant baseline differences, the reader is referred to Benjamin (1967) and Kinsman and Staudenmayer (1978).

The analyses of covariance described above revealed a significant behaviour type effect for HR, $F(1,39) = 5.38$, $p = .026$, and a behaviour type effect for SBP which approached significance, $F(1,39) = 3.98$, $p = .053$. As can be appreciated from Table 4.2 these results indicate that during the DSS task period, Type A subjects (regardless of condition) manifested higher elevations (from baseline) in HR (Mean change = 13.54 bpm) and in SBP (Mean change = 5.13 mmHg) than Type B subjects (Mean changes = 9.16 bpm and 0.95 mmHg, respectively). No other reliable terms or interactions for HR, SBP or DBP were found. In summary then, Type A subjects manifested greater cardiovascular reactivity than Type Bs in response to the challenge of working on a cognitive-motor task described as a test of intelligence. Analyses of covariance tables for HR, SBP, and DBP are presented in Appendices A.16 to A.18.

4.1.4.2 Self-reported physical symptoms

The pre-task measure of self-perceived present health was subjected to a 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analysis of variance. This analysis revealed no significant main effect or interactions. This suggests that Type A and Type B subjects did not differ in their pre-task self-perceptions of health status. The analysis of variance table for this variable is presented in Appendix A.19.

Ratings of the 14 items of the physical symptom checklist were summed up to yield a total symptom score (with higher scores representing a greater number and intensity of symptoms). The mean total symptom score for each behaviour type group and for each of the four type-condition cells are presented in Table 4.3. A 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analysis of covariance with pre-task ratings of self-perceived present health as the covariate, revealed a significant effect for behaviour type, $F(1,39) = 8.29$, $p = .006$. No other reliable terms or interactions emerged from this analysis. Therefore, it would appear that Type A subjects, regardless of condition, reported less symptoms than Type Bs. The analysis of covariance table for symptom report is presented in Appendix A.20.

In order to check which particular symptoms were under-reported by Type A subjects, each symptom was analyzed individually. It was found that Type A subjects, regardless of condition, reported less heart racing (M = 1.55, SD = 0.80), flushed face (M = 1.23, SD = 0.68) and sweaty hands (M = 1.59, SD = 0.91) than Type Bs (Ms = 2.18, 1.68, 2.27; SDs = 0.79, 0.72, 0.93, respectively), all Fs $(1,40) > 6.79$, $p < .055$. The complete analysis of covariance tables for each of these symptoms are presented in Appendices A.21 to A.23. It is interesting to note that these three symptoms appear to be associated with arousal-related changes in the cardiovascular system (see Weidner and Matthews, 1978).

Table 4.3

<u>Mean total symptom scores for Type A and Type B subjects in the Two-Minute and Four-Minute Conditions</u>

Expected Task Duration Conditions	Behaviour Type Groups		
	Type A	Type B	Condition Means
Two-Minute	16.82 (4.56)	18.73 (2.76)	17.77 (3.80)
Four-Minute	16.09 (2.95)	19.18 (3.06)	17.64 (3.33)
Type Means	16.45 (3.76)	18.95 (2.85)	

Note: The total symptom scores presented here are the sum of the ratings of 14 individual symptoms, each rated on a 7-point scale, where 1 = no symptom and 7 = severe symptom. For each behaviour type group N = 22. Standard deviations are presented in brackets. For each behaviour type-condition cell n = 11.

In view of the fact that Type A subjects exhibited greater elevations in HR than Type Bs, the finding that they reported less heart racing than Type Bs was particularly interesting and worthy of further exploration. Since the 7-point linear scale on which subjects were required to rate symptoms not only permitted the report of symptom intensity (ratings in the 2 to 7 range), but also the report of symptom absence (ratings of 1), it was possible to evaluate the likelihood of Type A and Type B subjects reporting the presence or absence of symptoms. It was reasoned that although Type A subjects reported less intense heart racing than Type Bs, they may have been as likely as Type Bs to report the presence of this symptom. Consideration of this possibility was thought to be important given that individuals may be more accurate about the presence or absence of a symptom than about the intensity of that symptom (see Pennebaker, 1982). In order to evaluate this possibility those subjects who had reported some degree of heart racing (that is, those who had made a rating of 2 or more on the 7-point scale) were allocated to the 'Report' Group, while those who had reported no 'heart racing' at all (that is, those who had made ratings of 1 on the 7-point scale) were allocated to the 'No Report' Group. A Chi-square of subject frequencies within this 2 (Types: A/B) x 2 (Groups: 'Report'/'No Report') design, revealed that Type A subjects were more likely than Type Bs to report no heart racing at all (or conversely, that Type B subjects were more likely than Type As to report some degree of heart racing), χ^2 (1, N = 44) = 5.93, p = .014. Therefore, Type A subjects may not only report less intense symptoms, but may fail to report their presence. Subject frequencies within each of the above mentioned cells are presented in Table 4.4.

In order to investigate the possibility that during task performance, Type A subjects may have experienced an elevated threshold for noticing changes in HR, the magnitude of the HR changes available for processing to Type A and Type B subjects who reported some degree of heart racing or who reported no heart racing at all, were statistically compared. HR change (elevation) scores were preferred over absolute levels of arousal because research has shown that individuals may encode change rather than absolute levels of physiological arousal (see Pennebaker, 1982). As can be appreciated from Table 4.4, Type A subjects in the 'Report' Group experienced greater elevations in HR than Type As in the 'No Report' Group, t(20) = 2.20, p = .039. Furthermore, Type As in the 'Report' Group experienced significantly greater elevations in HR than their Type B counterparts, t(23) = 2.57, p = .017, and than Type Bs in the 'No Report' Group, t(11) = 2.10, p = .020. It should also be noted that Type Bs in the 'Report' and 'No Report' Groups did not differ in terms of elevation in HR, t(20) = 0.04, p = .969.

Table 4.4

HR change (baseline-task period) scores (in bpm) for Type A and Type B subjects who reported or did not report some degree of heart racing (includes subject frequencies)

Heart Racing Report	Behaviour Type Group	
	Type A	Type B
Reported some degree of heart racing ('Report' Group)	17.88 (10.59) n = 8	9.19 (6.34) n = 17
Reported no heart racing at all ('No Report' Group)	11.07 (3.79) n = 14	9.07 (3.49) n = 5

Note: Standard deviations for mean HR change are presented in brackets.

The findings cited above indicate that while performing the challenging and demanding DSS task, Type A subjects were less likely than Type Bs to notice relatively subtle cardiovascular changes. Type A subjects who reported some degree of heart racing, appeared to have done so due to highly salient cardiac cues. On the other hand, Type B subjects were able to report changes of a smaller magnitude. Also consistent with the notion that during task performance, Type A subjects may have experienced an elevated threshold for detecting cardiac stimuli, is the finding that, despite exhibiting greater increases in HR, Type A subjects in the 'Report' Group ($M = 2.50$, $SD = 0.53$) failed to report more intense heart racing than their Type B counterparts ($M = 2.53$, $SD = 0.51$), $t(23) = 0.13$, $p = .896$. Therefore, it could be argued that even those Type As who reported some degree of heart racing failed to report the full extent of their HR change.

In an attempt to ascertain whether Type A and Type B subjects had based their ratings of heart racing on actual changes in HR, correlations were computed between these two variables for Type As and Type Bs separately. It should be pointed out that the coefficient for the Type A group was calculated using only data from 21 subjects. The reason for this was that, after close examination of the data, an outlayer with an extreme HR change of 40 bpm was discovered. The inclusion of this outlyer was judged inadvisable, since it would have distorted the degree of association between the two variables. The correlation coefficients for the Type A ($r = .09$, $n = 21$, $p = .336$) and Type B ($r = -.16$, $n = 22$, $p = .462$) groups were small and did not reach significant levels. It should be noted, however, that between subject correlations have been criticized as tests of the association between subjective report of bodily sensations and objective measures of these sensations. These correlations fail to account for individual benchmarks, from which different subjects may judge the experience of change in their level of arousal (see Pennebaker, 1982). It has been suggested that a more accurate evaluation of the association between self-reported and actual physiological changes may be obtained through within subject correlations (see Pennebaker, 1982). These correlations evaluate the degree of association between self-reported and actual bodily changes for each subject individually and take into account each individual's benchmark for judging change and the extent of this change. However, this procedure requires measurement of actual change and self reported change to be made on several occasions. Unfortunately, due to other considerations, this was not possible in Study 1.

4.1.4.3 Self-reported emotional distress symptoms

The baseline measure of state anxiety was subjected to a 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analysis of variance. This analysis revealed no significant main effects or interactions, which indicates that Type A and Type B subjects did not differ significantly in baseline levels of anxiety. The analysis of variance table for baseline state anxiety levels is presented in Appendix A.24.

State Anxiety ratings for the DSS task period were subjected to a 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analysis of covariance with baseline state anxiety as the covariate. This analysis revealed a types effect which approached significance, $F(1,39)$, $= 3.25$, $p = .079$. Examination of state anxiety levels for the baseline and task period, as well as baseline-task period change scores in Table 4.5, indicates that this effect was due to the fact that Type A subjects reported experiencing a smaller elevation in state anxiety during task performance than did Type Bs. No other reliable terms or interactions were found for state anxiety. The complete analysis of covariance table for the state anxiety variable is presented in Appendix A.25.

Table 4.5

Self-reported state anxiety for Type A and Type B subjects in the Two-Minute and Four-Minute Conditions for the baseline and task period (includes baseline-task period change scores)

Expected Task Duration Conditions	Behaviour Type Groups					
	Type A			Type B		
	Pre-task	Post-task	Change	Pre-task	Post-task	Change
Two-Minute	30.36	33.82	3.45	29.64	35.09	5.45
	(5.83)	(3.57)	(3.36)	(7.09)	(7.90)	(3.42)
Four-Minute	29.73	32.64	2.91	29.18	34.00	4.82
	(6.10)	(7.14)	(3.93)	(3.84)	(5.53)	(3.16)
Type Means	30.04	33.23	3.18	29.41	34.54	5.14
	(5.83)	(5.54)	(3.58)	(5.57)	(6.68)	(3.23)

Note: State anxiety is presented in raw scores. Change scores were computed for each subject by taking pre-task (baseline) scores away from post-task scores. Post-task scores represent retrospective ratings of state anxiety for the task period. Standard deviations are presented in brackets. For each behaviour type group N = 22. For each type-condition cell n = 11.

4.1.4.4 Measures of attention to task-relevant and task-peripheral stimuli

Attention to task-relevant stimuli during task-performance was assessed by a post-task recall test of the DSS symbols for digits 1 to 9. The number of symbols correctly recalled by subjects was subjected to a 2 (Types: A/B) x 2 (Conditions: Two/Four Minute) analysis of variance. This analysis revealed no significant difference in the number of symbols correctly recalled by Type A ($M = 5.77$, $SD = 1.38$) and Type B subjects ($M = 6.09$, $SD = 1.77$), $F(1,40) = 0.42$, $p = .519$, nor any other reliable term or interactions. The complete analysis of variance table for this variable can be found in Appendix A.26, while means and standard deviations for all groups can be found in Table 4.6.

Table 4.6
Means for measures of attention to task-relevant and task-peripheral stimuli for Type A and Type B subjects in the Two-Minute and Four-Minute Conditions

Expected Task Duration Conditions	Behaviour Type Groups					
	Type A			Type B		
	DSS symbols correctly recalled	DSS items correctly completed	Words correctly recognized	DSS symbols correctly recalled	DSS items correctly completed	Words correctly recognized
Two-Minute	5.73 (1.01)	78.09 (9.54)	2.73 (2.24)	6.00 (1.79)	81.27 (14.48)	2.81 (2.04)
Four-Minute	5.82 (1.72)	73.27 (11.45)	3.18 (1.83)	6.18 (1.83)	74.27 (13.94)	3.00 (2.05)
Type Means	5.77 (1.38)	76.09 (10.58)	2.95 (2.01)	6.09 (1.77)	77.77 (14.32)	2.90 (1.99)

Note: The maximum number of DSS symbols that could be correctly recalled was 9. 'DSS items correctly completed' refers to the number of digits correctly matched with their respective symbols during the first two minutes of DSS task performance. The maximum number of task-peripheral words that could be correctly recalled was 18. Standard deviations are presented in brackets. For each behaviour type group N = 22. For each type-condition cell n = 11.

Another way of assessing whether Type A subjects spent more effort than their Type B counterparts on the DSS task, is to compare the level of performance achieved by the two behaviour type groups. With this in mind, performance in the DSS task was quantified in terms of the number of items correctly encoded in the first two minutes of task performance. In keeping with the experimental design of Study 1, performance on the DSS task was analysed by a 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analysis of variance. This analysis revealed no significant difference between Type A ($M = 75.68$, $SD = 10.58$) and Type B ($M = 77.77$, $SD = 14.32$) subjects, $F(1,40) =$

0.19, p = .665, nor any other reliable term or interactions. The complete analysis of variance table for this variable is presented in Appendix A.28, while means and standard deviations for all groups can be found in Table 4.6.

Attention to task-peripheral stimuli during DSS task performance was assessed by a post-task recognition test of task-peripheral words presented in the DSS task sheet. The number of words correctly recognized by subjects was subjected to a 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analysis of variance. This analysis revealed no significant difference between Type A (M = 2.95, SD = 2.01) and Type B subjects (M = 2.91, SD = 2.00), F(1,40) = 0.01, p = .942. The analysis also failed to reveal any other reliable term or interactions. The complete analysis of variance table for this variable is presented in Appendix A.27. Means and standard deviations for all groups are presented in Table 4.6.

It should be noted that the lack of a significant between-types difference in the number of correctly recognized task-peripheral words may be a manifestation of the extreme difficulty of processing these words, rather than the absence of actual differences in the extent to which Type A and Type B individuals allocate attention to different aspects of the environment. It could be argued that the processing of task-peripheral words while attempting to complete the DSS task may have been so difficult, that it may have escaped even Type Bs' supposedly broader attention focus. Such notion is given credence by the fact that many subjects could not recall the words being present in the DSS task sheet and eight subjects (4 Type As and 4 Type Bs) failed to correctly recognize any task peripheral words.

In order to check whether effort on the DSS task and attention to DSS task-relevant stimuli were detrimental to the processing of task-peripheral stimuli, correlation coefficients were computed between, on the one hand, the number of correctly recognized task-peripheral words and, on the other hand, subjects' performance on the DSS task (that is, the number of DSS items correctly completed) and the number of DSS symbols correctly recalled after task performance. This was done separately for each behaviour type group.

As can be appreciated from Table 4.7, both the Type A and Type B groups exhibited negative and mostly significant correlations between these variables. That is to say, that the better their performance in the DSS task and the more they processed DSS symbols, the less capable subjects were of processing task-peripheral words. This observation confirms the notion that within a limited capacity model, attention to task-relevant stimuli would be detrimental to the processing of task-peripheral stimuli. Furthermore, as would be expected from the correlations described above, performance in the DSS task was significantly and positively associated with post-task recall of DSS symbols for both behaviour type groups (see Table 4.7). This observation confirms that attention to task-relevant aspects of the environment was associated with superior DSS task performance.

Table 4.7

Correlation coefficients between measures of recognition of task-peripheral stimuli, recall of task-relevant stimuli, and DSS task performance for each behaviour type group

Behaviour Type Groups	Type A group		
	Measures of recognition of task-peripheral stimuli, recall of task-relevant stimuli, and DSS task performance		
	(1) Words correctly recognized	(2) DSS symbols correctly recalled	(3) Performance on the DSS task
Type B group			
(1)		r = -.47 p < .030	r = -.70 p < .001
(2)	r = -.39 p < .080		r = .61 p < .004
(3)	r = -.59 p < .005	r = .64 p < .002	

Note: All coefficients were yielded by Pearson product-moment correlations. All coefficients and probability levels are based on N = 22.

Therefore, although attention to aspects of the environment relevant to the DSS task appears to have been detrimental to the processing of incidental task-peripheral stimuli, as noted earlier, no significant differences were observed in the extent to which Type A and Type B subjects processed task-peripheral and task-relevant stimuli during task performance. This observation provides no support for the notion that greater attention allocation to task-relevant stimuli and restricted processing of task-peripheral stimuli may have mediated Type A individuals' under-report of symptoms in Study 1.

Table 4.8

Mean confidence ratings for Type A and Type B subjects who correctly recognized at least one task-peripheral word

Expected Task Duration Conditions	Behaviour Type Groups	
	Type A	Type B
Two-Minute	2.41 (0.46) n = 8	1.90 (0.51) n = 9
Four-Minute	2.31 (0.30) n = 10	1.96 (0.54) n = 9
Type Means	2.35 (0.37) n = 18	1.93 (0.51) n = 18

Note: Confidence ratings were made on a 5-point scale in which a high score represented no confidence. Only subjects who correctly recognized at least one word were included in the analysis. Standard deviations are presented in brackets.

The only support for between-types differences in the allocation of attention comes from an indirect measure of this phenomenon, that is, subjects' ratings of how confident they were about having correctly recognized previously presented task-peripheral words. As will be recalled, these ratings were carried out on a 5-point linear scale, on which a low number represented a greater degree of confidence about a judgement being correct than a high number (see Appendix A.11). These ratings were subjected to a 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) analysis of variance. This analysis included only those subjects who had correctly recognized at least one task-peripheral word. Such analysis revealed that Type As (M = 2.35, SD = 0.37) were significantly less confident about their judgements than Type Bs (M = 1.93, SD = 0.51), $F(1,32) = 7.59$, $p = .010$. Whether this finding reflects Type A subjects' uncertainty due to their attention allocation policy (which may have resulted in weaker traces of task-peripheral words) or whether it simply reflects a more general tendency by Type A subjects to be more cautious than Type Bs, remains a matter of conjecture. It should be noted that no other significant main effects or interactions were found in the analysis of confidence ratings. The complete analysis of variance table for these ratings is presented in Appendix A.29. Mean confidence ratings for all groups are presented in Table 4.8.

4.1.5 Discussion

4.1.5.1 Evaluation of hypotheses concerning the replicability of previous findings

The results of Study 1 revealed that adult employed Type A male subjects responded to working on a cognitive-motor task, presented as a measure of intelligence, with greater cardiovascular arousal (as measured by HR and SBP) than did their Type B counterparts. This finding is consistent with those of previous studies in which Type A subjects have been observed to exhibit greater physiological arousal than Type Bs in response to challenging or threatening circumstances (e.g., Dembroski, MacDougall, Herd et al., 1979; Dembroski et al., 1978; Holmes et al., 1982; Manuck and Garland, 1979; Manuck et al., 1978). Furthermore, the findings of Study 1 serve to confirm that physiological hyper-responsiveness in the face of challenge is not restricted to Type A undergraduate university students. Study 1 demonstrated that this finding can be replicated in Type A employed adult males, who are more representative of those individuals on which the association between the TABP and CHD has been more consistently established (see Chapter 2 - Sections 2.1.1 to 2.2.3).

The greater elevation in cardiovascular arousal exhibited by Type A subjects relative to Type Bs appears to be at variance with data concerning subjects' self-report of physical symptoms and state anxiety. It could be argued that, viewed within the context of their greater elevations in HR and SBP, Type A subjects' smaller self-reported elevation in state anxiety, and the report of fewer and less intense physical symptoms, supports previous findings concerning these individuals' tendency to under-report physical and emotional distress symptoms (see Chapter 3 - Section 3.1.1).

It is particularly interesting to note that Type A subjects under-reported heart racing despite the fact that during DSS task performance, they exhibited significantly greater elevations (from baseline) in HR than Type Bs. It is also interesting to point out that even if HR fluctuations are asymptomatic, Type A subjects would have been expected to report more heart racing than Type Bs because of their tendency to exhibit greater increases in SBP. The basis for such proposition lies in the observation that fluctuations in SBP may be directly perceived and that one of the sensations which covary with fluctuations in SBP is self-reported HR (see Pennebaker, Gonder-Frederick, Stewart, Elfman, and Skelton, 1982). Furthermore, it has been suggested that fluctuations in SBP lead to the sensation of a pounding heart, which may be interpreted by individuals as meaning that their heart is beating quickly (see Pennebaker et al., 1982).

In summary then, the results of Study 1 confirmed that previous observations of Type A individuals' cardiovascular reactivity in response to challenging tasks and their under-report of this reactivity are replicable in employed adult men.

4.1.5.2 Evaluation of the hypothesis concerning the "suppression" explanation of Type A subjects' symptom under-report

It was hypothesized that if Type A individuals' symptom under-report was underlain by the non acknowledgement of symptoms as a strategy to ensure high levels of performance during ongoing challenging circumstances (see Carver et al., 1976; Weidner and Matthews, 1978), they would only under-report symptoms when stopped at what was allegedly the half way mark of the DSS task, but not after they had completed this task. However, contrary to Weidner and Matthews' (1978) findings, Type A subjects in Study 1 under-reported symptoms regardless of manipulations concerning expected task duration. This is to say that Type A subjects in Study 1 retrospectively reported fewer and less intense physical symptoms and smaller elevations in state anxiety for the task period, both when stopped at what they thought was the half way mark of DSS task performance and following the completion of this task. This finding is clearly inconsistent with the notion that Type A subjects would only fail to acknowledge symptoms during an ongoing challenging task, but would acknowledge these symptoms retrospectively after the completion of this task (see Weidner and Matthews, 1978).

Furthermore, it should be noted that consistent with the findings of Study 1, previous studies have observed that Type A subjects retrospectively report less intense symptoms than Type Bs, even after the completion of task performance (e.g., Dembroski et al., 1978; Holmes et al., 1982; Manuck and Garland, 1979; Manuck et al., 1978; Pittner and Houston, 1980).

In summary, it would appear that Type A individuals' under-report of symptoms may not be related to the denial of stimuli considered detrimental to ongoing task performance. It is not clear, however, why the undergraduate Type A female subjects in Weidner and Matthews' (1978) study reported fewer symptoms (retrospectively) than their Type B counterparts only when stopped in what they thought to be the half-way point of task performance, but not when they thought that they had completed the task. It can only be suggested that manipulation of expected task duration does not have the same effect on the symptom report pattern of employed Type A men as it does on the symptom report pattern of their female undergraduate student counterparts.

4.1.5.3 Evaluation of hypotheses concerning the 'attention focus' explanation of Type A subjects' symptom under-report

Study 1 cannot be said to have found direct support for an attention focus mediated explanation of Type A individuals' symptom under-report (see Matthews and Brunson, 1979; Weidner and Matthews, 1978). It was predicted that if Type A individuals' symptom under-report is underlain by greater allocation of attention to task-relevant aspects of the environment and to the restricted processing of task peripheral stimuli (including symptoms), Type A subjects in Study 1 should be less likely to correctly recognize task-peripheral information but more likely than Type Bs to accurately recall task-relevant stimuli. It was reasoned that since task-relevant and task-peripheral stimuli (including symptoms) compete for limited attention and processing capacity, Type A individuals who are immersed in a task which they consider important would be less likely to notice physical sensations and other task-peripheral external stimuli than Type B individuals who find the task to be less challenging or important.

In summary then, it was hypothesized that if Type A subjects' under-report of symptomatology was related to these subjects' greater allocation of attention capacity to task-relevant information, Type A subjects should not only report fewer and less intense symptoms, but have poorer recall of other task-peripheral stimuli and better recall of task-relevant stimuli. However, despite the fact that Type A subjects reported fewer and less intense physical symptoms, as well as smaller elevations in state anxiety, no between-types differences were observed in the post-task recognition of task-peripheral words or in the post-task recall of DSS task-relevant symbols.

As was noted earlier, failure to obtain direct evidence for between-types differences in the processing of task-peripheral words during the DSS task may have been related to the extreme difficulty inherent in having to process task-peripheral words during DSS task performance. This notion appears to be given credence by the anecdotal finding that a large number of subjects, from both behaviour type groups, reported to be unaware that the words had been presented in the DSS task sheet and that a considerable number of subjects failed to correctly recognize any words. It is possible then that actual between-types differences in attention allocation may not have been detected by the measurement of recognition of task-peripheral words, because processing of these words may have escaped even the supposedly broader attention focus of Type B subjects.

It should also be noted that no between-types differences were found in measures of attention to task-relevant stimuli. It seems peculiar that if (relative to Type Bs) Type As did in fact allocate a greater proportion of attention capacity to those aspects of the environment which were considered relevant to task completion, they did not recall more of this information than their Type B counterparts. However, it is possible that DSS symbols (recall of which was used as the measure of attention to task-relevant stimuli) may have been such crucial and salient element of task performance, that despite actual between-types differences in attention allocation, the extent to which Type B subjects attended to these symbols may have been sufficient to later produce a similar DSS symbol recall performance as that exhibited by Type A subjects (who supposedly allocated a greater proportion of attention capacity to such stimuli). In other words, there may be a limit to the extent to which allocation of attention can improve the recall of DSS task symbols. It is possible then, that the nature of both the task-peripheral and task-relevant stimuli selected for measurement in the present study may have militated against the finding of between-types differences in the processing of these stimuli.

Despite the lack of direct support for the attention focus explanation of Type A subjects' symptom under-report, some aspects of the data from Study 1 appear to be at least indirectly consistent with this hypothesis. Firstly, tentative support for the notion that Type A subjects may have processed task-peripheral stimuli to a different extent than Type Bs comes from the observation that Type A subjects endorsed their post-task recognition of task-peripheral words with a lesser degree of confidence. This finding could be interpreted to manifest the possibility that Type A subjects may have had available less strong traces for task-peripheral stimuli than did Type Bs, due to their limited attention to these stimuli during task performance. Secondly and more importantly, Type A subjects in Study 1 exhibited what appeared to be an elevated threshold for noticing changes in HR. That is to say, that Type A subjects required changes in HR of a greater magnitude than those required by Type Bs before reporting some degree of heart racing. Moreover, even when reporting some degree of heart racing, Type As reported a similar level of heart racing as their less aroused Type B counterparts. This observation appears to be consistent with the notion that during a challenging and/or demanding task, Type A subjects may be less capable of processing task-peripheral visceral stimuli. In other words, it is possible that because they allocate greater attention to what they consider important aspects of the environment, Type A individuals may exhibit an elevated viscerosomatic threshold, due to which subtle changes within the organism may go undetected, while changes of a greater magnitude are underestimated.

It could also be tentatively suggested that Type A subjects' report of smaller elevations in state anxiety in Study 1 may have been related to their unawareness of autonomic arousal. This proposition is consistent with viscerally based theories of emotion (see James 1884/1976; Schachter and Singer, 1962) which argues that the labeling of emotional experience and/or the attribution of affect depend on the perception of physiological arousal.

4.2 Introduction: Study 2

The two explanations of Type A individuals' symptom under-report investigated in Study 1 involved the suggestion that this phenomenon somehow represents a situation specific response. In the case of the hypothesis suggesting that Type A individuals may under-report symptoms because of their desire to ensure high levels of performance (see Carver et al., 1976; Weidner and Matthews, 1978), it is the threat or challenge of ongoing task performance which is seen as eliciting the non acknowledgement of symptoms. In the case of the hypothesis suggesting that Type A individuals' may under-report symptoms because of their disproportionate allocation of attention to task-relevant stimuli (see Matthews and Brunson, 1979; Weidner and Matthews, 1978), it is the processing demands and priorities imposed by an important task which are seen as eliciting reduced processing and thus lack of awareness of task-peripheral stimuli (such as symptoms). As was noted earlier, however, no support was found in Study 1 for the former hypothesis and at best only tentative and indirect support was found for the latter.

The fact that there appears to be no clear evidence that Type A individuals' symptom under-report may be situationally elicited raises the possibility that this phenomenon may be underlain by dispositional rather than situational factors. One such possible dispositional factor is that of a poorly developed ability to perceive visceral sensations. That is to say, that relative to Type Bs, Type A individuals may have a less well developed ability to perceive visceral sensations, which may affect their report of symptoms regardless of situational characteristics. After an extensive review of the literature, the author could not find any studies which had investigated this possibility.

4.2.1 Dispositional differences in visceral perception

Examination of the literature on autonomic self-regulation and on the effects of awareness of autonomic arousal on the report of emotion indicates the existence of individual dispositional differences in the ability to perceive visceral sensations (e.g., Brener, 1977, 1978; Hantas, Katkin, and Reed, 1984; Jones and Hollandsworth, 1982; Katkin, Blascovich, and Goldband, 1981; Mandler, Mandler, and Uviller, 1958; Schandry, 1981). Furthermore, this research has demonstrated that individual differences in visceral perception ability are related to the strength of self-reported emotional experience (e.g., Hantas, Katkin, and Blascovich, 1982; Katkin et al., 1982; Schandry, 1981). Specifically, it has been observed that despite exhibiting similar levels of physiological arousal, individuals classified as 'good visceral perceivers' report more intense emotional experience than individuals assessed to be 'poor visceral perceivers' (e.g., Hantas, Katkin, and Blascovich, 1982; Katkin et al., 1982; Schandry, 1981). This finding is consistent with the Jamesian (James, 1884/1976) view that the perception of visceral arousal is an integral element of emotional experience.

Individuals differences in visceral perceptiveness are not only relevant to the experience of emotion, but also to the experience of physical symptoms and the onset of regulatory processes. For example, the reorientation of behaviour contingent upon fluctuations in the milieu interieur (see Adam,1967, 1978; Mackay, 1980) appears to be indicative of the important role played by the processing of visceral sensations in both conscious and unconscious homeostatic functions.

Information about changes and events within the organism are said to be available from the cortex, which acts as an integrating mechanism for information received from the various physiological systems (see Eysenck, 1975). However, Brener and Jones (1974) argue that only small areas of the cortex are devoted to the perception of visceral stimuli and that the cortical projections of visceral afferents are not localized with respect to either topography or function. Obviously, these factors would militate against fine discrimination of visceral stimuli (see Mackay, 1980).

Chernigovskiy (1967) suggests that visceral perception is based on four types of receptors which are thought to monitor the milieu interieur; mechanoreceptors, chemoreceptors, osmoreceptors, and thermoreceptors. However, since individuals have not learned to localize these receptors or label specific internal stimuli, the perception of visceral sensations when verbally expressed tends to refer to general states of the organism (Brener, 1978).

A variety of objective techniques designed specifically to evaluate accuracy in visceral perception had been described in the autonomic self-regulation literature and in the literature dealing with the physiological measurement of emotion (e.g., Brener, 1977; Brener and Jones, 1974; Katkin, Morell, Goldband, and Bernstein, 1980, McFarland, 1975; Schandry, 1981; Whitehead, Drescher, Heiman, and Blackwell, 1977). Owing to the simplicity of its measurement (and the fact that it can be objectively quantified by polygraph recordings), most techniques for measuring individual differences in visceral perceptiveness involve the evaluation of the accuracy with which subjects are capable of detecting heart beats. However, little is known about the processes mediating perception of heart beats. Schandry (1981) remarks that there is evidence to suggest that heart beat can be perceived at least by some subjects, but only tentatively suggests that heart beats are primarily perceived in the chest and to a lesser extent in the neck and head. Sandman (1986) has been more precise, suggesting that each ventricular contraction of the heart propagates a bolus of blood through the vascular system which is detected as a resonating pulse. Other researchers have suggested that autonomic perception may be related to right cerebral hemispheric activation (see Davison, Horowitz, Schwartz, and Goodman, 1981; Luria and Simernitskaya, 1977; Walker and Sandman, 1979, 1982).

The reasons underlying individual differences in visceral perceptiveness are not clear, but given that visceral perceptiveness is considered an acquired or developed skill, it seems reasonable to suggest that individual differences in this ability may come about as the result of learning experiences (see Adam, 1978). Consistent with this notion is the observation that the degree of parental attentiveness to children's health is positively associated with the extent of symptom report in adulthood (see Mechanic, 1972; Pennebaker, 1982, 1983).

4.2.2 Objective of Study 2

In view of the fact that individual differences in visceral perceptiveness may have their origin in early socialization and that these differences have been shown to affect symptom report, it is interesting to note the evidence suggesting that Type A and Type B individuals may be the product of different parenting and other socialization influences (e.g., Glass, 1977; Matthews, 1977, 1981; Waldron, 1978). These differences may render Type As generally less sensitive than Type Bs to visceral sensations. For example, parental insistence upon and reward for trying harder (see Matthews, 1977, 1981) could be hypothesized to lead Type A children to disregard visceral sensations and be less concerned with monitoring the milieu interieur. Therefore, it would seem reasonable to question whether between-types differences in dispositional visceral perceptiveness may underlie differences in the symptom report pattern of Type A and Type B individuals, particularly in view of the lack of clear and direct support provided by Study 1 for hypotheses emphasizing the situationally induced nature of this phenomenon.

In summary, the objective of Study 2 was to ascertain whether a less well developed dispositional ability to perceive visceral stimuli could account for Type A individuals' tendency to under-report symptoms. This possibility was evaluated with the use of a cardiac perception task designed by Schandry (1981) to assess individual differences in visceral perception. This task involves the quantification of subjects' accuracy in detecting the occurrence of heart beats during certain time intervals. Prior to the task, subjects are not trained to discriminate heart beats, so that the task represents an attempt to assess naturally occurring between-types differences in visceral perceptiveness. During this cardiac perception task, subjects are required to attend to heart beats and are not distracted by other experimental tasks. In that sense the cardiac perception task could also be taken as an evaluation of Type A subjects' ability to process visceral stimuli while not distracted from these stimuli by more pressing external demands. It should be noted, however, that contrary to the possible beneficial effects of focussed attention on awareness of elevations in HR in Study 1, discrete heart beats are events too subtle for focussed attention to improve their awareness (Adam, 1978; Mackay, 1980). Therefore, Study 2 was primarily an investigation of possible between-types differences in the dispositional (naturally occurring) ability to perceive visceral stimuli and not a test of how focussed attention and freedom from distractions may improve the processing of visceral stimuli.

4.2.3 Hypotheses

(1) It was hypothesized that if Type A subjects' symptom under-report was related to a dispositional tendency to have a less well developed ability to detect visceral stimuli, Type A subjects would perform significantly worse than Type Bs in the cardiac perception task.

(2) Since the same subject sample participated in Studies 1 and 2, it was possible to investigate whether symptom report in Study 1 could be accounted for in terms of subjects' dispositional ability to perceive visceral sensations (as measured by performance in the cardiac perception task in Study 2). No firm hypotheses could be formulated for this investigation. However, based on previous findings indicating that dispositional visceral perceptiveness (as assessed by cardiac perception tasks) is related to strength of self-reported symptoms, it was expected that within both behaviour type groups, the report of physical symptoms (and in particular heart racing) and elevations in state anxiety in Study 1, would be positively associated with visceral perception ability (as measured by performance in the cardiac perception task in Study 2).

4.2.4 Method

4.2.4.1 Subjects

Subjects taking part in Study 2 were the same employed male adult subjects who participated in Study 1. Therefore, descriptive data presented for subjects in Study One is also relevant to Study 2.

4.2.4.2 Materials and apparatus

During the cardiac perception task HR was measured with plate electrodes attached to the subject's chest and was recorded using a Grass polygraph. Blood pressure was measured by a Copal digital sphygmomanometer. Respiration frequency was measured by a pneumatic air displacement belt strapped around the subject's diaphragm and recorded by a Grass polygraph.

4.2.4.3 Procedure

The experimental procedures followed in Study 2 were modeled on those described by Schandry (1981).

After completion of Study 1, all subjects were informed that prior to the estimation of their aerobic capacity (which had been promised to them in exchange for participation), they would be required to rest for a period of 10 minutes. At this stage, however, subjects were not informed that they would be required to perform a cardiac perception task. It should be noted that since all subjects had participated in Study 1, electrodes were already attached to their chest and a BP cuff was already strapped around their non dominant arm. Subjects were seated in a semi reclining position on a chair with flat armrests, in a sound-deadened laboratory. The temperature was maintained between 20 and 22°C and the laboratory was dimly illuminated during the experimental session.

The last 5 minutes of the 10-minute rest period were used as a baseline during which HR and respiration frequency were continuously recorded, while one BP recording was carried out during the 40-second period beginning at the end of the fourth minute of the baseline. At the completion of the 5-minute baseline period, subjects were instructed that they were to perform a task which involved the "counting of heart beats". Specifically, they were told: "I want you to try to count your heart beats by concentrating on bodily feelings, which you think may be associated with the action of the heart". They were also told that "for different people this means different things" and that, therefore, the experimenter was unable to specifically suggest any way in which the task should be done. Furthermore, subjects were instructed that they were to count their heart beats without taking their pulse or trying any other manipulation (including momentarily suspending respiration) that may facilitate the detection of heart beats. They were also instructed to sit comfortably and quietly while concentrating on heart beats. It is interesting to note Crigg's (1984) suggestion however, that naive subjects tend not to manipulate respiratory or muscular activity to solve cardiac perception tasks.

Finally, subjects were instructed that they were to count their heart beats during three periods, the beginning and end of which would be announced by the onset of a soft tone. Subjects were then given a demonstration of the soft tone, following which the experimenter stationed himself behind a partition, ready to record the subject's responses and activate the soft tone at predetermined times. The activation of the soft tone triggered a marking pen in the polygraph being used to record HR and respiration frequency. This allowed the experimenter to later compare polygraph recordings and the number of heart beats counted by subjects during perception periods.

The cardiac perception task was performed three times, for periods of 25, 35, and 45 seconds duration respectively, separated by 30 second rest intervals. It is important to note that subjects were not informed of the duration of the perception intervals. The following series of alternating rest and perception intervals was followed for each subject: rest (60 seconds), perception (25 seconds), rest (30 seconds), perception (35 seconds), rest (30 seconds), perception (45 seconds), rest (60 seconds). HR and respiration frequency were recorded for all perception and rest intervals. In order not to artificially facilitate heart beat detection by the inflation of the BP cuff (see Brener and Jones, 1974; Ross and Brener, 1981), BP readings were not taken during perception intervals. However, one blood pressure reading was taken for the 40 seconds beginning at the end of the first 20 seconds of the last rest period.

Upon completion of all measures related to the cardiac perception task, all subjects were administered a test of aerobic capacity and their percentage body fat was measured using calipers. Subjects were then debriefed and thanked for their participation. Those individuals who had volunteered in response to the first recruitment drive but who, because of their non extreme Type A scores, were not selected for participation in Studies 1 and 2, were also provided with measures of their aerobic capacity and percentage body fat.

4.2.5 Results

4.2.5.1 Accuracy of cardiac perception

The accuracy of heart beat perception was quantified as a total error quotient (see Schandry, 1981). This score was derived by calculating the difference between reported and actual number of heart beats for each perception interval and then dividing the product by the actual number of heart beats in the respective perception interval. The total error quotient was the sum of the absolute values of the three perception intervals error scores. Therefore, a high total error quotient reflected less accuracy in visceral perception than a low total error quotient.

As can be appreciated from Figure 4.1 there was a wide variation in the accuracy with which Type A and Type B subjects were able to discriminate heart beats. This is consistent with Katkin's (1985) conclusion that methods for testing cardiac discrimination are sensitive enough to allow objective and quantitative assessment of heart beat discrimination, but that task demands are sufficiently difficult that few subjects are able to perform well. However, the fact that some some subjects were able to accurately perceive heart beats without any training, tends to confirm that there are dispositional individual differences in the ability to perceive visceral sensations.

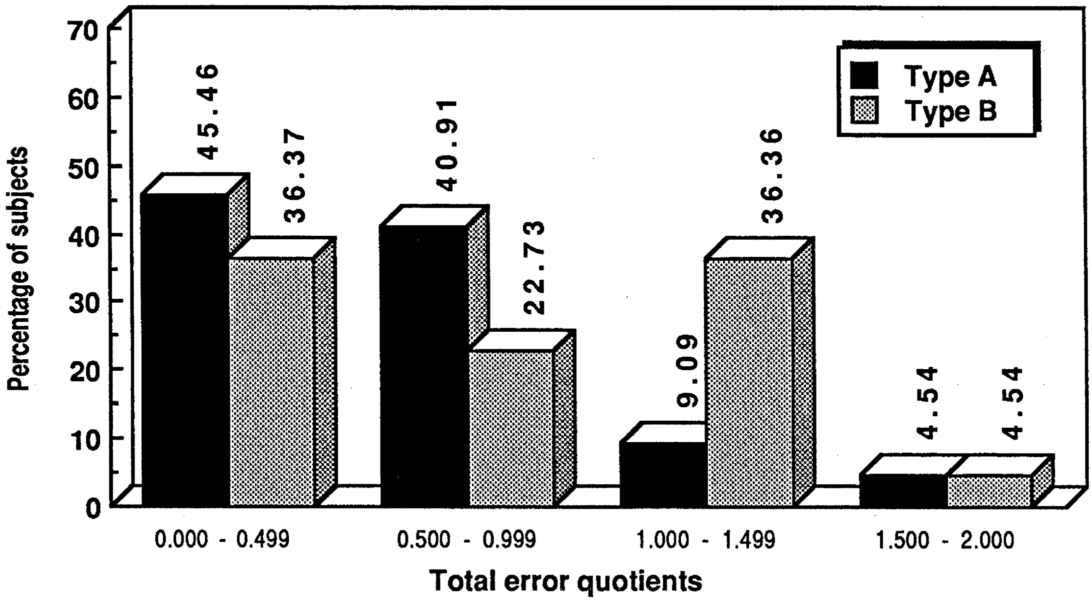

Figure 4.1

Distribution of total error quotients among Type A and Type B subjects and percentages of subjects within each behaviour type group scoring within different ranges of the distribution. For each behaviour type group N = 22.

In an effort to ascertain whether there were significant differences between Type A and Type B subjects' dispositional ability to perceive heart beats, a statistical comparison of the total error quotients of these two groups was carried out. This analysis revealed no significant difference between Type A (M = 0.610, SD = 0.395) and Type B subjects (M = 0.774, SD = 0.540), $t(42) = 1.15$, $p = .257$. Furthermore, contrary to expectations and as indicated by the direction of the means, there was a non significant tendency for Type A subjects to be more accurate than their Type B counterparts. This tendency was also reflected in the analysis of raw error scores. Raw error scores for each perception interval were calculated by adding the number of heart beats which subjects missed or incorrectly counted. Therefore, raw error scores do no take into account the subject's HR for that period, as do error quotients. Statistical analysis of mean raw error scores revealed a between-types difference which approached significance, $t(42) = 1.86$, $p = .070$. Specifically, Type A subjects ($M = 7.20$, $SD = 4.34$) tended to miss and/or incorrectly count fewer heart beats than Type Bs ($M = 10.78$, $SD = 7.89$).

Evaluation of the cardiac perception task performance of Type A and Type B subjects also included assessment of these subjects' ability to achieve perfectly accurate heart beat counts. A perfect count was defined as that in which the number of heart beats counted by the subject differed by no more than plus or minus two heart beats from the actual number of heart beats recorded by the polygraph during a given perception interval. This deviation of plus or minus two heart beats was allowed because it was considered that subjects could be confused (and thus miss or add heart beats) by the onset of the soft tone which was activated to signal the beginning and end of perception intervals.

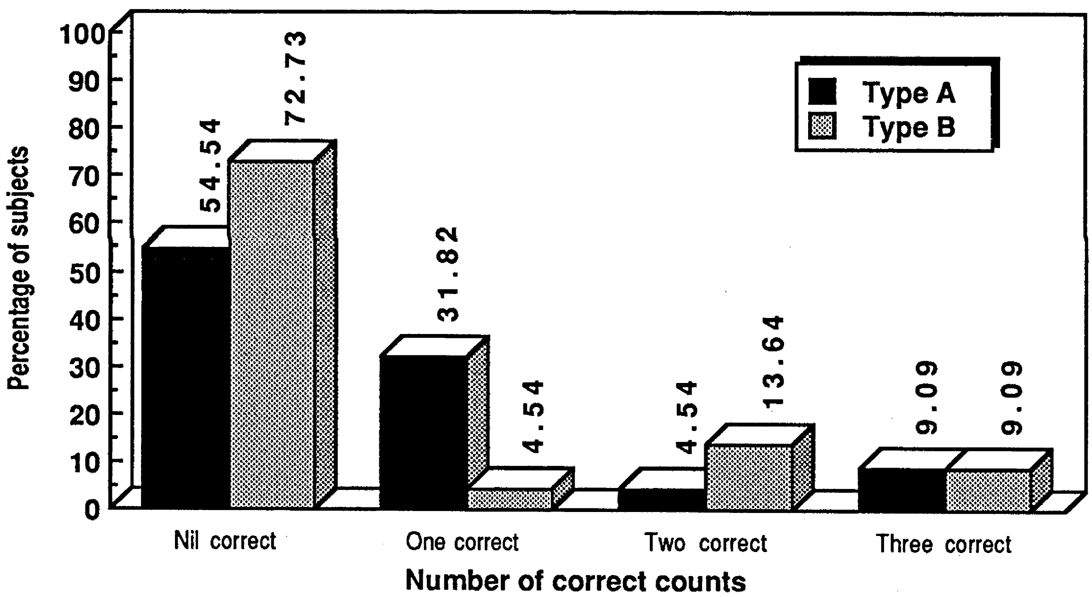

Figure 4.2

Percentage of Type A and Type B subjects who achieved none, one, two or three perfect heart beat counts during three perception intervals. For each behaviour type group N = 22.

Figure 4.2 presents the percentage of Type A and Type B subjects who achieved none, one, two, or three perfect heart beat counts. Given the small number of subjects achieving two and three perfect heart beat counts, for the purpose of statistical analysis it was necessary to group subjects who achieved at least one perfect heart beat count. A Chi-square analysis of subject frequencies was carried out for this 2 (Types: A/B) x 2 (Groups: No Perfect Counts/At Least One Perfect Count) data arrangement. In all, 16 subjects achieved at least one accurate count. Of these, 10 were Type As and 6 were Type Bs. The remaining 28 subjects (12 Type As and 16 Type Bs) failed to achieve perfect counts in all of the three perception intervals. The Chi-square analysis of these subject frequencies revealed no significant tendencies for either Type A or Type B subjects to be more or less likely to have achieved perfect counts, χ^2 (1, N = 44) = 0.884, p = .347.

The fact that some subjects were capable of achieving perfect scores without any training, while others were not, also tends to support the notion that there are dispositional individual differences in the ability to perceive visceral sensations.

4.2.5.2 Visceral perception ability and the report of symptoms in Study 1

In order to ascertain whether dispositional ability to perceive visceral sensations (as measured by performance in the cardiac perception task in Study 2) was related to subjects' self-reported physical and emotional distress symptoms in Study 1, correlation coefficients between, on the one hand total error quotients, and on the other hand, self-reported total symptoms, self-reported "heart racing", and self-reported elevations in state anxiety were computed. The coefficients yielded by these analyses were significant and negative for the Type B group (r = -.42, N = 22, p = .049; r = -.43, N = 22, p = .045; r = -.49, N = 22, p = .020, respectively), but not for the Type A group (r = .11, N = 22, p = .629; r = .01, N = 22, p = .993; r = -.06, N = 22, p = .784, respectively).

Given that high total error quotients represent poorer visceral ability than low total error quotients, these correlation coefficients indicate that in Study 1, Type B subjects' report of physical symptoms and elevations in state anxiety may have been influenced by the subjects' dispositional ability to perceive visceral sensations. This observation is consistent with previous findings in the area of visceral perception research, which have indicated a significant positive association between accurate visceral perception and strength of self-reported emotional distress (see Hantas et al., 1982; Katkin et al., 1982; Schandry, 1981).

However, as depicted by the nonsignificant correlations for the Type A group, dispositional visceral perceptiveness (as measured by performance in the cardiac perception task in Study 2) did not predict symptom report in Study 1. It is not clear why, despite exhibiting similar levels of dispositional visceral perceptiveness as Type Bs, Type A subjects were unable to make use of this ability in processing symptom stimuli in Study 1. This observation is even more intriguing if one considers that Type A subjects were more physiologically aroused in Study 1 than were Type Bs and thus had more salient visceral stimuli available for processing.

Table 4.9

Mean total error quotients (derived from Study 2) for Type A and Type B subjects who reported or did not report some degree of heart racing (in Study 1)

Heart Racing Report	Behaviour Type Groups	
	Type A	Type B
Reported some degree of heart racing ('Report' Group)	0.543 (0.285) n = 8	0.652 (0.461) n = 17
Reported no heart racing at all ('No Report' Group)	0.647 (0.452) n = 14	1.188 (0.634) n = 5

Note: The total error quotients were derived by first computing the error score for each perception interval. This was done by calculating the difference between reported and actual number of heart beats for each perception interval and then dividing the product by the actual number of heart beats in the respective perception interval. The total error quotient is the sum of the absolute values of the three perception interval error scores. A high total error quotient reflects less accurate visceral perception than a low total error quotient. Standard deviations are presented in brackets.

In order to ascertain whether visceral perception ability (as assessed by performance in the cardiac perception task in Study 2) was associated with the report of the heart racing symptom in Study 1, the total error quotient of subjects who had reported some degree of heart racing and of those who reported no heart racing at all were statistically compared. Table 4.9 presents the mean total error quotients derived from performance in the cardiac perception task (in Study 2) for Type A and Type B subjects who reported some degree of heart racing or who reported no heart racing at all (in Study 1). These groups were labelled 'Report' and 'No Report', respectively.

As can be appreciated from Table 4.9, Type B subjects in the 'No Report' Group (in Study 1) were the worst performers in the cardiac perception task (in Study 2). Statistical comparisons between the group means in Table 4.9 confirmed that Type B subjects in the 'No Report' Group obtained significantly higher total error quotients than their 'Report' Group counterparts, $t(20) = 2.10$, $p = .048$, Type As in the 'No Report" Group, $t(17) = 2.07$, $p = .050$, and Type As in the 'Report' Group, $t(11) = 2.40$, $p = .035$. On the other hand, Type A subjects in the 'Report' and 'No Report' Groups did not differ significantly in their performance in the cardiac perception task, $t(20) = 0.59$, $p = .564$. Furthermore, the cardiac perception task performance of Type A 'Report' Group subjects did not differ significantly from that of their Type B counterparts, $t(23) = 0.61$, $p = .548$.

Given that Type B 'Report' and 'No Report' Group subjects exhibited similar elevations in HR in response to the DSS task (and thus had similarly salient cardiac stimuli available for processing - see Section 4.1.4.2) and that Type B 'Report' Group subjects exhibited significantly better dispositional visceral perceptiveness than their "No Report' Group counterparts (see Table 4.9), it would be reasonable to argue that it was only superior dispositional visceral ability which determined the report of the heart racing symptom among Type B subjects in Study 1. However, the same argument cannot be used to account for the report of heart racing within the Type A group. Both 'Report' and 'No Report' Type A subjects exhibited similar levels of dispositional visceral perception ability, but 'Report' Group subjects exhibited significantly higher elevations in HR (see Section 4.1.4.2). Therefore, it was only the salience of the cardiac stimuli available for processing which separated 'Report" and 'No Report' Type A subjects. Furthermore, despite exhibiting similar elevations in HR in response to the DSS task (see Section 4.1.4.2) and exhibiting similar levels of dispositional visceral perceptiveness (see Table 4.9) as Type B 'Report' Group subjects, 'No Report' Type A subjects failed to report heart racing. These observations raise the question as to why, in Study 1, apparently 'good visceral 'perceivers' among Type A subjects, were unable to make use of their demonstrated ability to process visceral stimuli even when these stimuli were of similar magnitude to those available for processing to 'good visceral perceivers' in the Type B group. The answer to this question is not clear, although a number of observations tentatively support the notion that during the performance of DSS task in Study 1, Type A subjects may have experienced an elevated threshold for noticing task-peripheral stimuli, including symptoms (see Section 4.1.5.3)

4.2.5.3 Physiological measures

High levels of physiological activation and manipulation of breathing patterns have been suggested to facilitate performance in cardiac perception tasks (e.g., Schandry, 1981; Blascovich and Katkin, 1983). Therefore, measures of HR, BP, and respiration frequency were included as a way of evaluating whether individual differences, and possibly between-types differences in accuracy of heart beat detection could be attributed to a different manipulation of breathing frequency and/or different magnitude of cardiac stimuli available to each group.

Means and standard deviations for all physiological measures during all measurement periods are presented in Table 4.10. As can be appreciated from this table, all subjects, regardless of behaviour type classification, appeared to have experienced a relaxation response from baseline to rest and perception periods. This suggests that subjects responded to the cardiac perception task by slowing physiological activity and respiration frequency.

Although HR and respiration were measured over a number of periods (i.e., baseline, rest, and perception intervals), these measures do not strictly lend themselves to repeated measures analysis of variance because values for rest and perception intervals represented the means for three non consecutive periods. However, in order to assess the significance of the slowing down of responses across periods of measurement and in order to check whether the rate of slowing was different across behaviour type groups, 2 (Types: A/B) x 3 (Periods: Baseline/Rest/ Perception) repeated measures analyses of variance (which assumed a temporal arrangement of baseline, rest, and perception periods, in that order), were carried out for HR and respiration frequency.

These analyses revealed significant periods effects for HR, $F(2,84) = 5.41$, $p = .006$, and for respiration frequency, $F(2,84) = 4.28$, $p = .017$, thus confirming a slowing down of responses from baseline to perception intervals. No other significant terms or interactions were observed. This indicates that there were no significant between-types differences in the rate of slowing or in the absolute levels of HR and respiration frequency during any of the measurement periods. Therefore, although

Type A and Type B subjects may have attempted to detect cardiac events by manipulating their HR and respiration frequency, the extent to which they may have done so, and the magnitude of cardiac stimuli available for processing to Type A and Type B subjects were similar. The complete repeated measures analyses of variance tables for HR and respiration frequency are presented in Appendices B.1 and B.2.

Table 4.10

Group means and standard deviations for all physiological measures during all measurement periods in the cardiac perception task

Period of Measurement	Physiological Measures							
	HR (bpm)		Respiration frequency (per minute)		SBP (mmHg)		DBP (mmHg)	
	Behaviour Type		Behaviour Type		Behaviour Type		Behaviour Type	
	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B
Baseline	67.30	68.88	13.47	13.75	122.68	122.04	79.91	79.32
	(10.83)	(10.58)	(2.77)	(2.47)	(12.89)	(9.20)	(11.51)	(8.47)
Rest intervals	66.84	69.17	13.36	13.80				
	(9.51)	(9.38)	(2.52)	(2.16)				
Perception intervals	65.49	67.26	13.03	13.48				
	(9.52)	(7.56)	(2.48)	(2.06)				
Post -task					121.64	120.82	79.27	80.91
					(11.71)	(8.47)	(11.51)	(9.33)

Note: Baseline scores for HR and respiration frequency were computed for each subject by calculating the mean for the last 2 minutes of the baseline period. Means for rest intervals represent the mean value for the four rest intervals. Means for perception intervals represent the mean value for the three perception intervals. SBP and DBP were not measured during rest and perception periods. Standard deviations are presented in brackets. For each behaviour type group N = 22.

The slowing of physiological responses from baseline to rest and perception periods in the present study is inconsistent with findings in a similar study conducted by Schandry (1981). Schandry observed significant increases from rest to perception periods in respiration frequency and HR. The reasons behind these differences in physiological reactions and/or purposeful manipulation of physiological activity between Schandry' (1981) sample and the present one are not clear.

In order to check for between-types differences in BP in Study 2, data on SBP and DBP collected just before and after the cardiac perception task were subjected to 2 (Types: A/B) x 2 (Periods: Pre-Task/Post-Task) repeated measures analyses of variance. The analysis of SBP data revealed a significant decrease in SBP levels from baseline to the post-task measurement period, $F(1,42) = 6.37$, $p = .016$, but no other reliable terms or interactions. Analysis of DBP data revealed no significant terms or interactions. The complete repeated measures analysis of variance tables for SBP and DBP are presented in Appendices B.3 and B.4.

In general, analyses of the physiological data from Study 2 suggest that levels of physiological activity and/or possible attempts at slowing this activity were similar across behaviour type groups. This observation suggests that the between-types comparison in cardiac perception task performance represented a valid evaluation of possible differences in Type A and Type B subjects' dispositional ability to detect discrete cardiac stimuli.

4.2.6 Discussion

The results of the cardiac perception task suggest that Type A individuals are not dispositionally less perceptive of visceral stimuli than their Type B counterparts. In fact, results from Study 2 suggest a non significant tendency for Type A subjects to exhibit higher dispositional visceral perception ability than Type Bs. This observation is interesting, given that in Study 1 the same Type A subjects appeared to be unable to accurately process cardiac arousal related stimuli as efficiently as Type Bs.

Based on Type A subjects' performance in the cardiac perception task (in Study 2), one would have expected that they would be as capable as Type Bs of processing visceral stimuli. However, while dispositional visceral ability (as measured by performance in the cardiac perception task in Study 2) was a predictor of physical and emotional symptom report within the Type B group in Study 1, this was not the case within the Type A group. The factors which may have prevented Type A subjects from processing or reporting visceral sensations in Study 1 are not clear, although the results of Study 2 indicate that this is not due to dispositionally poorer visceral processing ability.

It is worth pointing out that a conceptual distinction may be made between the estimation of heart racing in Study 1 and the counting of heart beats in Study 2. While HR (and heart racing) may be inferred from the perception of heart beats and time estimation, heart beats may be perceived directly (see Blascovich and Katkin, 1983). This suggests that heart beat perception may represent a more fundamental cardiac perception process. Therefore, it is possible that the cardiac perception task (in Study 2) only assessed subjects ability to perceive discrete cardiac events. Nonetheless, this finding is still relevant to the discussion of between-types differences in the dispositional ability to process other dimensions of cardiac events and other visceral stimuli. This proposition appears to be supported by the fact that within the Type B group, visceral perception ability (as measured by performance in the cardiac perception task in Study 2) was significantly correlated with the report of symptomatology in Study 1.

4.3 General Discussion

Study 1 served to replicate previous findings in regards of Type A individuals' tendency to under-report physical and emotional distress symptoms. However, no support was found for the notion that this phenomenon involves the non acknowledgement of stimuli considered detrimental to ongoing important task performance (see Carver et al., 1976; Weidner and Matthews, 1978). Furthermore, no clear support was obtained for the notion that Type A subjects' symptom under-report is related to the maximal allocation of attention to task-relevant stimuli and the restricted processing of task-peripheral stimuli (see Matthews and Brunson, 1979 Weidner and Matthews, 1978). There were indications, however, that the nature of the task-relevant and task-peripheral stimuli employed in Study 1 may have militated against the finding of between-types differences in attention allocation.

Despite the lack of direct support for the 'attention allocation' explanation of Type A individuals' symptom under-report, there were aspects of the data from Study 1 which were consistent with this explanation.

Firstly, Type A subjects appeared to be less confident about their post-task recognition of task-peripheral stimuli presented during DSS task performance. This finding may indicate that Type A subjects experienced restricted processing of task-peripheral stimuli which was manifested in lower confidence than Type Bs in the recognition of these stimuli. Secondly, Type A subjects required changes in HR of a greater magnitude than those required by Type Bs, before reporting the presence of the heart racing symptom. Thirdly, Type A subjects who did report some degree of heart racing, reported the same intensity of this symptom as their less aroused Type B counterparts. These findings are consistent with the notion that Type A subjects may have exhibited an elevated viscerosomatic threshold which prevented them from noticing subtle physiological changes and led them to underestimate the intensity of changes of greater magnitude.

Study 2 sought to ascertain whether Type A subjects' symptom under-report could be attributed to between-types differences in the dispositional ability to perceive visceral sensations. However, Type A and Type B subjects were found to perform at a similar level in a cardiac perception task designed to assess this disposition. Interestingly, while Type B subjects' dispositional visceral ability (as assessed by performance in the cardiac perception task in Study 2) predicted symptom report in Study 1, the same was not the case within the Type A group. This observation suggests that in Study 1, Type A individuals' visceral perceptive processing was disrupted. It is possible that this disruption may have occurred as a consequence of the disproportionate allocation of attention to task-relevant aspects of the environment, at the expense of visceral stimuli. However, it should be stressed that Study 1 provided only limited evidence for this hypothesis.

An issue which also deserves consideration is whether Type A individuals are dispositionally less prone than Type Bs to focus their attention on visceral sensations. Although the results of Study 2 showed Type A subjects to be as capable as Type Bs of processing visceral stimuli, these results were obtained under conditions in which subjects were specifically requested to attend to this information. It is possible that, although Type A subjects may be as capable as Type Bs of processing visceral stimuli, they may be dispositionally prone to attend less regularly than Type Bs to physical sensations. The term 'dispositional' is used here once again to express the possibility that Type As may attend less habitually to visceral sensations, regardless of the presence or absence of challenging and/or demanding external stimuli. Consideration of this possibility was judged a prudent step before embarking on further investigation of the inconsistently supported attention focus explanation of Type A subjects' symptom under-report (see Study 1). Chapter 5 describes a study which was designed to investigate the possible association between Type A behaviour and the dispositional tendency to habitually allocate attention to visceral stimuli.

CHAPTER 5

5.1 Introduction: Study 3

Studies 1 and 2 (see Chapter 4) failed to provide a clear indication of the processes underlying Type A individuals' symptom under-report. Study 1 failed to find support for the notion that Type A individuals' symptom under-report may involve the non acknowledgement of stimuli considered detrimental to ongoing performance in an important task. Furthermore, Study 1 provided only indirect support for the notion that Type A individuals' symptom under-report may be related to their greater allocation of attention to task-relevant stimuli at the expense of task-peripheral stimuli. Study 2 revealed that Type A and Type B subjects did not differ in the extent to which they exhibited dispositional ability to process visceral stimuli.

One possibility not investigated in the previous studies is that between-types differences may exist in the dispositional (rather than situationally elicited) tendency to habitually attend to symptoms. Over the last decade an important body of literature has emerged which suggests that the dispositional tendency to habitually attend to private, as opposed to public aspects of the self and body, is positively associated with the accuracy and intensity of self-reports concerning internal states (e.g., Gibbons et al., 1979; Miller et al., 1981; Scheier et al., 1979). Study 3 was designed to assess the association between the TABP and this disposition.

5.1.1 Dispositional self and body consciousness

The concept of self consciousness refers to the effect of dispositional attention focus on awareness about aspects of the self (see Buss, 1980; Carver, 1974, 1975; Carver and Scheier, 1978; Buss and Scheier, 1976; Duval and Wicklund, 1972, 1973; Scheier and Carver, 1977; Scheier, Buss, and Buss, 1978; Scheier et al., 1979; Wicklund, 1975). According to self consciousness theory, some individuals rarely attend to aspects of the self, while other individuals regularly attend to these aspects (see Buss, 1980). This theory distinguishes between private and public aspects of the self. That is to say, while some aspects of the self (such as bodily feelings, motives or self-reflections) can only be sensed by the experiencing person, other aspects (such as appearance, style or manners) can be observed by others (see Buss, 1980). Further, self consciousness theory proposes that privately self-focussed individuals habitually attend to private aspects of the self, while individuals who are publicly self-focussed are more concerned about their appearance and overt behaviour and therefore attend more frequently to these aspects. Regardless of whether they attend to private or public aspects of themselves, self-aware persons are said to attend mainly to themselves, not to others (see Buss, 1980).

According to self consciousness theory, a person whose attention is dispositionally directed to private aspects of the self should be more cognizant of bodily feelings and reactions, arousal states, emotions, memories of childhood, personality traits, motives, and self-reflections than a person whose attention is directed elsewhere (see Buss, 1980; Carver and Scheier, 1978; Buss and Scheier, 1976; Scheier and Carver, 1977; Scheier et al., 1979).

The measure of dispositional self consciousness most commonly cited in the literature is the Self Consciousness Scale (Fenigstein, Shire, and Buss, 1975). This instrument is a self-report inventory composed of three subscales: the Private Self Consciousness Subscale (PSCS), the Public Self Consciousness Subscale (PUSCS), and the Social Anxiety Subscale. For the purpose of the research reported in this thesis, only the PSCS and the PUSCS are discussed in detail.

The Self Consciousness Scale was developed to assess individuals' standing in seven different areas which the authors believed to be representative of self consciousness. These areas were: "(a) preoccupation with past, present, and future behaviour; (b) sensitivity to inner feelings; (c) recognition of one's positive and negative attributes; (d) introspective behaviour; (e) a tendency to picture or imagine oneself; (f) awareness of one's physical appearance and presentation; and (g) concern over the appraisal of others" (Fenigstein et al., 1975, p. 523).

Factor analysis of items tapping these seven areas yielded three interpretable factors which accounted for 43% of the variance. One of these factors was considered to represent the disposition to attend to inner thoughts and feelings. Items from this factor made up the PSCS. Two sample items from the PSCS are: "I'm generally attentive to my inner feelings" and "I'm always trying to figure myself out". The second factor was considered to reflect the disposition to perceive oneself as a "social object". Items from this factor made up the PUSCS. Two sample items from the PUSCS are: "I'm usually aware of my appearance" and "I'm concerned about my style of doing things". The remaining factor was said to reflect a discomfort in the presence of others and was named "social anxiety".

The Self Consciousness Scale was revised to a final version containing 23 items which are rated on a 5-point scale, where 1 represents a rating of an item as "extremely uncharacteristic" and 5 as "extremely characteristic" of the rater.

Correlations between the PSCS and the PUSCS have been invariably positive, but generally low to moderate, typically falling in the high .20s and low .30s (see Carver and Glass, 1976; Fenigstein et al., 1975; Turner, Scheier, Carver, and Ickes, 1978). These low to moderate correlations suggest that private and public self consciousness are theoretically different and relatively empirically independent. However, the fact that in some samples they do correlate moderately, suggests that to some extent persons who report attending to one aspect of the self also report attending to other aspects.

Fenigstein et al. (1975) report that a two week test-retest reliability check on a sample of 84 undergraduate university students indicated that the PSCS ($r = .79$) and the PUSCS ($r = .84$) are reasonably reliable.

Relatively little research has been reported on the validity of the PUSCS. However, it is known that persons scoring high on this subscale are more sensitive to rejection by a peer group than low scorers (Fenigstein, 1974), a finding which is consistent with Fenigstein et al.'s (1975) notion of public self consciousness.

Several studies have yielded evidence to suggest that persons scoring high on the PSCS are more cognizant of private aspects of the self than persons scoring low in this subscale. For example, high scores on the PSCS have been shown to be positively associated with the veridical nature of self-reported aggressiveness (Scheier et al., 1978) and with the intensity of self-reported transient affective states, such as anger in response to insult (Scheier, 1976), discomfort in response to slides of atrocities and elation and depression in response to mood induction techniques (Scheier and Carver, 1977). Particularly relevant to the discussion concerning awareness of internal states is the finding that persons scoring high on the PSCS are less influenced by false suggestions regarding a particular gustatory sensation than persons scoring low in this subscale (see Gibbons et al., 1979; Scheier et al., 1979).

Another measure of dispositional self consciousness was designed by Miller et al. (1981). This measure, the Body Consciousness Scale, attempts to apply the private/public self consciousness distinction to awareness about bodily processes and states in a more direct manner than the Self Consciousness Scale by requiring respondents to rate their attention allocation to different aspects of the body.

The Body Consciousness Scale is made up of three subscales: the Private Body Consciousness Subscale (PBCS); the Public Body Consciousness Subscale (PUBCS), and the Body Competence Subscale. For the purpose of the research reported in this thesis, only the PBCS and the PUBCS are described in detail.

According to Miller et al. (1981), the PBCS measures a chronic disposition to focus on internal bodily sensations, while the PUBCS measures a chronic disposition to focus on and be concerned with the external appearance of the body. Items relevant to these two aspects of the body were found to load on separate, overlapping factors (see Miller et al., 1981). Some of the items in the PBCS refer to awareness about specific physical sensations, such as dry mouth, heart beating, and stomach contractions, while the remaining items of this subscale refer to awareness about more generalized changes, such as tension and fluctuations in temperature. Some of the items in the PUBCS refer to grooming, such as appearance of hands, skin, and hair, while the remaining items refer to enduring features of one's body, such as waist size, body build, and posture.

Miller et al. (1981) report that in a sample of 628 subjects, scores on the PBCS and PUBCS were moderately correlated (r = .37). This suggests that to some extent persons who report attending to private aspects of the body also attend to public aspects. Miller et al. (1981) also report reasonable two month test-retest reliability coefficients for the PBCS (r = .69) and the PUBCS (r = .73). These researchers also found that scores on the PBCS correlate moderately with scores on Fenigstein et al.'s (1975) PSCS and PUSCS (r = .37, r = .30, respectively). On the other hand, scores on the PUBCS were moderately correlated with scores on the PSCS and highly correlated with scores on the PUSCS (r = .32, r = .71, respectively). The correlation between the PUBCS and the PUSCS is sufficiently strong to suggest that both subscales are measuring approximately the same disposition (i.e, attention to public aspects of the self and body). However, the moderate correlation between scores on the PSCS and PBCS suggests that there is a conceptual distinction to be made between private body consciousness and private self consciousness and that these two constructs represent different dimensions of self-awareness.

Miller et al., (1981) found that subjects scoring high on the PBCS appeared to be relatively more aware of the stimulating effect of caffeine (and thus reported more caffeine related symptoms) than subjects scoring low on this subscale. On the other hand, awareness of physiological changes after ingestion of caffeine was not found to be related to scores on the PUBCS. The validity of the PUBCS appears to be supported by

Miller and Cox's (1980) finding that women scoring high on this subscale were more concerned with their physical appearance (as measured by the use of cosmetics) than were low scorers.

5.1.2 Objective of Study 3

Study 3 was designed to investigate the association between dispositional self consciousness and Type A behaviour. It was reasoned that between-types differences in the dispositional tendency to habitually attend to private aspects of the self and body may account for Type A individuals' symptom under-report.

Possible differences in the socialization experiences of Type A and Type B individuals (e.g., Glass, 1977; Matthews, 1977, 1981; Waldron, 1978) may promote between-types differences in the disposition to habitually attend to private aspects of the self and body. In fact the development of individual differences in dispositional self consciousness is said to occur through the shaping influence of socialization agents and experiences (see Buss, 1980, Mechanic, 1980).

Mechanic (1980) suggests that parental behaviour may play an important role in directing the child's attention to internal states and in causing the child to adopt a body monitoring orientation. This observation is relevant to the phenomenon under investigation in this thesis, if one considers that a possible effect of being encouraged by both their parents and others to try harder and compete (see Glass, 1977; Matthews, 1977) may lead Type A children to adopt a body monitoring orientation which is less acute than Type Bs.

Few studies have investigated the association between Type A behaviour and dispositional self consciousness. Herman et al. (1981) found that Type A individuals appeared to be unaware of certain aspects of their personality and behaviour, but particularly those aspects which could be construed as socially undesirable. Thus it is not clear whether Type A individuals in Herman et al.'s (1981) study were genuinely less aware of aspects of their behaviour and personality or were simply less willing to report those aspects which were considered not socially desirable.

After an extensive search of the literature, only two studies directly investigating the association between Type A behaviour and Fenigstein et al.'s (1975) Self Consciousness Scale were found. Smith and Brehm (1981) reported a small but significant positive correlation between Type A behaviour (as measured by the JAS) and private self consciousness (as measured by the PSCS) in a sample of female undergraduate university students. This finding suggests that contrary to expectations, Type A individuals may be privately self conscious. However, Herbertt and Innes (1982) found no significant correlation between Type A scores on the JAS and the Bortner Scale and scores on the PSCS in a sample of male and female undergraduate university students.

In summary, investigations of the association between Type A behaviour and dispositional private self consciousness have been inconclusive and limited to populations of undergraduate university students. No investigations of the association between Type A behaviour and dispositional private body consciousness were found in an extensive review of the literature.

5.1.3 Hypotheses

(1) It was hypothesized that if Type A individuals' symptom under-report was related to a dispositional tendency to attend less habitually to private aspects of the self and body, correlations between scores on the JAS subscales and on the PSCS and PBCS should yield significant negative coefficients. Therefore, Type A behaviour and private self and body consciousness were expected to be inversely correlated.

(2) Investigation of the association between Type A behaviour and public self and body consciousness was not considered immediately relevant to the phenomenon under investigation in this thesis because theoretically, dispositional public self and body consciousness would not appear to be associated with awareness of internal states (see Buss, 1980). However, given Type A individuals' apparent concern with their social presentation (see Price, 1982), it was tentatively hypothesized that scores on the JAS may be positively correlated with scores on the PUSCS and the PUBCS.

5.1.4 Method

5.1.4.1 Subjects

Subjects participating in Study 3 were drawn from the total pool of 83 volunteers who responded to the initial recruitment drive for male participants, aged between 20 and 60 years. Seven of these potential subjects failed to adequately complete one or more of the measures of self and body consciousness and were later unavailable to complete these questionnaires. Therefore, only the data for the 76 subjects who returned completed PSCS, PUSCS, PBCS and PUBCS questionnaires were included in assessing the association between dispositional self and body consciousness and Type A behaviour. The descriptive data for this group of subjects is presented in Table 5.1.

Table 5.1

Means and standard deviations for age and the four subscales of the Form C of the JAS for the total number of volunteers who returned scorable PSCS, PUSCS, PBCS and PUBCS questionnaires

	Total Volunteer Population			
	Mean	SD	Range	N
JAS (Form C) Subscales				
Type A	229.55	68.39	74 - 383	76
Speed & Impatience	177.21	62.89	42 - 306	76
Hard-Driving & Competitive	108.15	24.62	67 - 171	76
Job Involvement	228.68	46.75	121 - 313	76
Age				
Years	33.25	7.76	25.055 - 58.030	76

Since the 76 subjects in Study 3 comprised a large proportion of the group of 83 who volunteered to participate in Studies 1 and 2, it is not surprising to observe that the descriptive data for these two groups (which is shown in Tables 4.1 and 5.1) are similar.

5.1.4.2 Material

Subjects were required to complete Form C of the JAS (Jenkins et al., 1979), which is described in detail in Chapter 1. A copy of Form C can be found in Appendix A.1. Subjects were also required to complete the PSCS and the PUSCS of the Self Consciousness Scale (Fenigstein et al., 1975) as well as the PBCS and the PUBCS of the

Body Consciousness Scale (Miller et al., 1981). These scales were described earlier in this chapter. Copies of these instruments can be found in Appendices C.1 and C.2. Items on the PSCS and PUSCS were rated on a 5-point scale with a range of 1 to 5, while items on the PBCS and PUBCS were also rated on a 5-point scale, but with a range of 0 to 4. In all four scales low ratings reflect the subject's belief that the attribute, attitude or behaviour depicted by an item was "extremely uncharacteristic" of him, while high ratings reflect the subject's belief that an item depicted an attribute, attitude or behaviour "extremely characteristic" of him. High scores in the PSCS, PUSCS, PBCS, or PUBCS reflect greater dispositional private or public self/body consciousness than low scores.

5.1.4.3 Procedure

Individuals who responded to the first recruitment drive were mailed a copy of the JAS and the PSCS, PUSCS, PBCS, and PUBCS with instructions to complete these questionnaires as soon as possible and to return them by pre-paid mail. As noted in Chapter 4, only extreme scorers on the Type A subscale of the JAS were selected for participation in Studies 1 and 2. It is important to note that subjects were not informed of the possibility that they may not be selected for participation in experimental studies until they had returned the completed questionnaires. The subjects not selected for participation in Studies 1 and 2 were nonetheless offered measures of aerobic capacity and percentage body fat.

5.1.5 Results

The mean scores on the PSCS, PUSCS, PBCS, and PUBCS for the 76 subjects who returned completed questionnaires were 22.75 (SD = 6.56), 16.09 (SD = 5.04), 10.65 (SD = 4.06) and 12.25 (SD = 4.45) respectively. These scores were similar to those reported by Fenigstein et al.'s (1975) and Miller et al. (1981).

The association between dispositional self and body consciousness and Type A behaviour was examined by computing a matrix of correlation coefficients for all JAS (Form C) subscales and the PSCS, PUSCS, PBCS, and PUBCS. This matrix is presented in Table 5.2.

Table 5.2 shows that all but two of the coefficients for correlations among JAS subscales were moderately to highly significant (the Hard-Driving and Competitive subscale did not relate to either the Speed and Impatience or the Job Involvement subscales). This suggests that generally speaking the JAS subscales are not measuring entirely independent constructs. The reason for the lack of a significant correlation between the Hard-Driving and Competitive subscale and the Speed and Impatience and the Job Involvement subscales is not clear, but similar findings have been reported by others (see Matthews et al., 1982).

Table 5.2

Matrix of correlation coefficients for the four JAS (Form C) subscales and the PSCS, PUSCS, PBCS, and PUBCS

	JAS (Form C) Subscales			Self and Body Consciousness Subscales			
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
JAS (Form C)							
(1) Type A	r = .60†††	r = .27†	r = .36††	r = .19	r = .12	r = .13	r = .13
(2) Speed & Imp.		r = .26†	r = -.04	r = .13	r = .10	r = .14	r = .01
(3) Job Invol.			r = .02	r = -.07	r = -.01	r = .05	r = .08
(4) Hard-Driving				r = .01	r = -.05	r = .08	r = -.04
Self Consciousness							
(5) PSCS					r = .54†††	r = .41†††	r = .49†††
(6) PUSCS						r = .35†††	r=.66†††
Body Consciousness							
(7) PBCS							r = .56†††
(8) PUBCS							-------

Note: All coefficients were yielded by Pearson product-moment correlations. All coefficients and probability levels are based on N = 76.

††† = $p < .001$
†† = $p < .010$
† = $p < .050$

Intercorrelations between measures of dispositional self consciousness revealed that the PSCS correlated with the PUSCS somewhat more strongly than had been the case in previous studies (see Carver and Glass, 1976; Fenigstein et al., 1975; Turner et al., 1978). The PBCS and the PUBCS were also somewhat more strongly correlated than in previous studies (see Miller et al., 1981). These observations suggest that subjects who report to habitually attend to private aspects of the self and body also report habitually attending to public aspects. This casts some doubt on the assumption that private and public self and body consciousness (as measured by the Self Consciousness and Body Consciousness Scales) are theoretically different and relatively empirically independent.

Correlations between scores on the PSCS and the PBCS, and between the PUSCS and the PUBCS were also moderately high. This casts further doubts on the empirical independence of these measures.

It was hypothesized that if Type A individuals' symptom under-report was related to the dispositional tendency to less habitually attend to private aspects of the self and body, then scores on the PSCS and PBCS would be significantly and inversely correlated with measures of Type A behaviour. However, there were no significant correlations between these variables (see Table 5.2). What is more, the coefficients yielded by these correlations were positive (see Table 5.2).

No firm hypotheses were formulated regarding the association between Type A behaviour and dispositional attention to 'public' aspects of the self and body. Nonetheless, it is interesting to note that not any of the four JAS subscales were found to correlate with either the PUSCS or the PUBCS.

In order to confirm that there was no association between the TABP and dispositional self and body consciousness, all measures were subjected to factor analysis. This procedure employed a principle components analysis with varimax rotation. Based on Child's (1976) guidelines as to the suitability of data for factor analysis, the data for all measures were examined for excessive bimodality, skeweness, and truncated distributions. This examination revealed that the data for all measures were suitable for factor analysis.

Following Child's (1976) suggestion, Kaiser's criterion was employed in selecting factors for consideration. This criterion determines that only those factors with eigenvalues greater than one should be considered. It should also be noted that only factor loadings greater than 0.3 were selected. According to Child (1976), this limitation represents a rigorous criterion, suitable for the analysis of data derived from between 50 and 300 subjects. Table 5.3 presents the factor loadings for the three factors with eigenvalues greater than one, yielded by the procedures described above.

Factor one in Table 5.3 appears to represent the dimension of self consciousness, with private and public self and body consciousness loading on it. In factor one, there appears to be a slight emphasis on 'public' aspects of the self and body, with the PUSCS and PUBCS loading slightly more strongly on this factor than the PSCS and PBCS. The second factor appears to represent the Type A behavioural dimension, with an emphasis on speed and impatience. The third factor appears to represent another dimension of the TABP, with an emphasis on hard-driving and competition. More importantly, it should be noted that both private self consciousness and private body consciousness failed to load on either of the Type A factors. This confirms that there is no relationship between dispositional self or body consciousness and the TABP.

Table 5.3

Factor analysis of all JAS (Form C) subscales and the PSCS, PUSCS, PBCS, and PUBCS

Factors	(1)	(2)	(3)
Eigenvalues	3.116	1.974	1.282
Proportion of common variance	28.3%	18.0%	11.7%
JAS (Form C) Subscales			
Type A	----	.733	.499
Speed and Impatience	----	.851	----
Job Involvement	----	.664	----
Hard-Driving and Comp.	----	----	.956
Self Consciousness			
PSCS	.762	----	----
PUSCS	.812	----	----
Body Consciousness			
PBCS	.712	----	----
PUBCS	.865	----	----

5.1.6 Discussion

It has been argued that the PSCS and the PBCS measure the dispositional tendency to habitually attend to private aspects of the self and body and to be dispositionally cognizant of these aspects (see Fenigstein et al., 1975; Miller et al., 1981). Relative to low scores, high scores in both of these subscales had been found to be associated with more accurate self reports of arousal states (Miller et al., 1981; Scheier et al., 1978), more intense self-reported physical and emotional states (Miller et al., 1981; Scheier, 1976; Scheier and Carver, 1977) and greater resistance to accept false suggestions regarding physical sensations (Gibbons et al., 1979; Scheier et al., 1979).

It was reasoned that given the symptom under-report phenomenon exhibited by Type A individuals and evidence that these individuals may be the product of socialization influences (see Glass, 1977; Matthews 1977, 1981; Waldron, 1978) which may promote the development of a less acute body monitoring orientation, it was prudent to ascertain whether Type A behaviour was inversely related to dispositional self and body consciousness.

However, the data from Study 3 provide no support for the hypothesis that JAS-defined Type A behaviour in employed adult men may be inversely related with the dispositional tendency to habitually attend to private aspects of the self and body as measured by the PSCS and PBCS. In fact the direction of the coefficients yielded by correlation analyses (see Table 5.2) suggest that if any association exist between Type A behaviour and dispositional self and body consciousness, it may be in the positive direction. Furthermore, factor analysis of all measures failed to revealed any meaningful loading of self or body consciousness on the TABP construct.

These results are generally consistent with those reported by Herbertt and Innes (1982). These researchers found no significant association between Type A behaviour and private self consciousness in a group of male and female university students.

Having found no between-types differences in dispositional variables known to affect the report of physical sensations and physical and emotional states (in Studies 2 and 3), it was judged necessary to reconsider the possibility that Type A individuals' symptom under-report may manifest not a stable trait but a situation elicited phenomenon.

The research reported in the next chapters sought to elaborate upon the tentative and indirect support offered by Study 1 for the hypothesis that Type A subjects' symptom under-report may represent a situation specific, attention focus mediated phenomenon. Particular emphasis was placed on the investigation of the situational characteristics which may elicit between-type differences in attention focus and on the incidental processing of task-peripheral stimuli. Emphasis was also placed on the use of experimental paradigms and stimuli more closely related to the processing of visceral stimuli than had been the case in previous investigations of between-types differences in attention allocation (see Matthews and Brunson, 1979; Stern et al., 1981).

CHAPTER 6

6.1 Introduction: Study 4

Findings concerning the lack of significant associations between JAS-defined Type A behaviour and measures of dispositional private self and body consciousness (see Study 3 - Chapter 5) and those concerning the lack of significant between-types differences in dispositional visceral perception ability (see Study 2 - Chapter 4), suggest that Type A individuals' symptom under-report may not represent a stable trait. Therefore, reconsideration of situation specific factors which may lead Type A individuals to under-report symptoms appears to be indicated.

As will be recalled, Study 1 (see Chapter 4) provided somewhat tentative support for the notion that Type A individuals' symptom under-report may be underlain by restricted processing of task-peripheral stimuli. It was observed that Type A subjects in Study 1 were less confident than Type Bs about their ability to accurately recognize task-peripheral stimuli. This finding could be interpreted to be consistent with Type A subjects' hypothesized restricted processing of task-peripheral stimuli during performance of an important task.

Also consistent with the view that in Study 1 Type A subjects may have experienced restricted processing of task-peripheral stimuli, these subjects were found to require elevations in heart rate (HR) of a greater magnitude (than required by Type Bs), before reporting the occurrence of the heart racing symptom. Furthermore, even when reporting the heart racing symptom, they appeared to underestimate its magnitude. It may be argued that these observations manifest an elevated viscerosomatic threshold by which Type A individuals fail to detect subtle physiological changes and underestimate changes of a greater magnitude.

The above observations suggest that the hypothesis that Type A individuals' symptom under-report may be underlain by the restricted processing of task-peripheral stimuli is worthy of further investigation.

6.1.1 Objectives of Study 4

Study 4 sought to reconsider the possibility that Type A individuals' symptom under-report may be related to the restricted processing of task-peripheral stimuli during performance of challenging or threatening (important) activities (see Matthews and Brunson, 1979; Weidner and Matthews, 1978). Specifically, Study 4 attempted to test for between-types differences in the processing of artificially produced physical sensations under conditions which varied in the extent to which a primary task represented an ego challenge or threat (and was thus important) and was cognitively taxing or demanding. This represented a dual task paradigm, within which task-peripheral physical stimuli and their processing were presented as a secondary task rather than being treated as incidental events (as was the case with task-peripheral words in Study 1). This design is not ideal in evaluating the role of attention allocation in symptom perception because in every day life individuals are not usually forewarned about the occurrence of physical sensations and their attention is not explicitly directed to these sensations (Pennebaker, 1982).

In Study 4, the experimenter was forced to forewarn subjects about the possible occurrence of task-peripheral stimuli during primary-task performance because they were required to report these stimuli at the time of detection (rather than post-task) and because the intensity of task-peripheral artificially produced physical sensations needed to be calibrated before the commencement of primary-task performance.

However, the positive effect of the above methodological step is that the experimenter could exercise control over the intensity of task-peripheral artificially produced physical sensations and that it permitted measurement of subjects' processing of physical sensations at the time that these sensations occurred. This means that stimulation could be calibrated so as to ensure relatively similar subjective experiences across subjects and that the evaluation of between-types differences in the processing of physical sensations was not based on measures of (possibly erroneous) post-task retrospective recall of these sensations.

Furthermore, the use of artificially induced sensations as task-peripheral stimuli may be seen as representing an improvement over the use of task-peripheral words in Study 1 and the use of other symptom-unrelated task-peripheral stimuli in previously published studies of between-types differences in attention allocation (see Matthews and Brunson, 1979; Stern et al., 1981). Data related to subjects' ability to detect artificially produced physical sensations can be argued to be more relevant to the discussion of the sensory mechanisms involved in the processing of naturally occurring physical sensations than data concerning subjects' ability to process a light stimuli, a noise distractor (see Matthews and Brunson, 1979) or mood labels (see Stern et al., 1981).

6.1.2 Hypotheses

Hypotheses for Study 4 were based on previously described principles of attention and information processing (see Chapter 3 - Section 3.1.3) and the accumulated research findings on Type A individuals' susceptibility to psychosocial challenges and threats (see Chapter 1 - Sections 1.3, 1.5 and Chapter 2 - Section 2.2.3). Before formulating the hypotheses for Study 4, let us briefly review both of these areas and elaborate on the line of reasoning which led to these hypotheses.

According to Pennebaker (1982, 1983), physical sensations represent only one of many potential sources of information which compete for processing. With particular reference to the processing of symptoms, Pennebaker indicates that the probability of detecting physical sensations is inversely related to the salience, novelty, complexity, and importance of external stimuli available for processing at any given time (Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980). In order to understand this proposition, one must consider it within the long established and well documented phenomenon of limited attention capacity (see Easterbrook, 1959; Kahneman, 1973; Navon and Gopher, 1973). The limited capacity model of attention assumes that attention capacity at any given moment is limited, and that only a finite amount of information can be processed at any given time. Within this model, the allocation of a certain proportion of attention capacity to a given stimulus means that less than total capacity is available to process other stimuli. Therefore, since according to Pennebaker's model of symptom perception (Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980), complex, novel or important external stimuli may be given priority for processing, in the presence of these stimuli an individual would be left with relatively little capacity to process other stimuli, such as physical sensations.

Type A individuals have been shown to respond to certain psychosocial challenges and threats with physiological and behavioural hyper-responsiveness (see Chapter 1 - Sections 1.3, 1.5 and Chapter 2 - Section 2.2.3). This pattern of responding is assumed to underlie a certain motivation which, although not clear at this stage, appears to have overtones of a need to control the environment, to be seen as successful, to obtain social recognition, and to protect the ego (see Chapter 1 - Section 1.5). These motivations could be hypothesized to not only lead Type A individuals to react with greater physiological and behavioural arousal to relevant eliciting circumstances, but also to cause these individuals to concentrate their attention on those aspects of the environment which are relevant to the successful mastery of what they perceive as a challenge or threat. A consequence of this state of affairs may be that

Type A individuals end up with less spare attention capacity than Type Bs to process other stimuli, including changes within the body.

Therefore, it can be argued that the restricted processing of visceral sensations may represent another manifestation of Type A individuals' hyper-responsiveness to situations which they consider important to master or control. One of the experimental conditions which has been observed to elicit behavioural and physiological hyper-responding from Type A individuals is that which confronts these individuals with performing a task presented as highly diagnostic of ability (e.g., Holmes et al., 1982; Malcom et al., 1984). Based on this observation and the line of reasoning described above, it was hypothesized that Type A subjects asked to perform a cognitive-motor task presented as a test of intellectual ability, would consider this task and its successful completion important, and as consequence would allocate a greater proportion of their attention capacity to this task than Type Bs. Given limited attention capacity (see Easterbrook, 1959; Kahneman, 1973; Navon and Gopher, 1973), Type A subjects' relatively extreme allocation of attention to the important task at hand can be expected to lead these individuals to exhibit restricted processing of physical sensations.

Thus, the following was hypothesized concerning the possible effects of the experimental manipulations in Study 4:

(1) Type A subjects receiving ego challenging instructions (Challenge Condition) would allocate a greater proportion of their attention capacity to the task at hand than Type A subjects not receiving these instructions (No Challenge Condition) and than Type Bs regardless of instructions. This would lead Type A Challenge Condition subjects to exhibit restricted processing of task-peripheral physical sensations which was expected to manifest itself in significantly poorer detection of, and slower responses to these stimuli.

Since the complexity of the external environment has been shown to be inversely related with the capacity of individuals to process visceral stimuli (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980), Study 4 also included the manipulation of primary task complexity. Complex stimuli make more demands from processing capacity and attract more attention than relatively simple stimuli (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980). Relative to the processing of simple stimuli, processing of more complex stimuli may leave the individual with less spare capacity to process other stimuli (including symptoms).

In Study 4, subjects in both Challenge and No Challenge Conditions were required to work on a primary task which had two levels of complexity. This manipulation represents an attempt to investigate the effects of external stimuli complexity in the processing of task-peripheral physical sensations. It was reasoned that Type A individuals would assign greater importance to a complex task than to a relatively simple task because the former represents a greater challenge or threat.

The following hypotheses concerning the effects of task complexity were formulated:

(2) Based on Pennebaker's model of symptom perception (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980), it was hypothesized that for all subjects (regardless of behaviour type or condition), primary task complexity would have a detrimental effect on the detection and speed of processing of task-peripheral physical sensations. Therefore, it was expected that subjects would be slower to respond to electrical stimulation and would detect fewer presentations of these stimuli when performing a difficult task than when performing a relatively simple task.

(3) It was also hypothesized, that the addition of primary task complexity to ego challenging instructions would have the effect of enhancing the importance of the task at hand for Type As, thereby further promoting attention allocation to task-relevant aspects of the environment at the expense of task-peripheral stimuli. It was expected that this would be manifested in a significantly poorer rate of detection and slower speed of processing of task-peripheral physical sensations for Type A Challenge Condition subjects when performing a difficult primary task than when performing a simple primary task.

(4) It was reasoned that in the absence of ego challenging instructions, Type A subjects may also exhibit more restricted processing of task-peripheral stimuli than Type Bs, if the primary task is sufficiently difficult to be perceived as a threat or challenge. Therefore, it was tentatively hypothesized that during performance of a relatively difficult task, Type A subjects (regardless of challenge condition) may exhibit poorer detection of, and slower responses to task-peripheral stimuli than when performing a relatively easy task and than their Type B counterparts.

6.1.3 Method

6.1.3.1 Overview and design

Subjects were required to perform a cognitive-motor task under one of two conditions of ego challenge (Challenge or No Challenge Conditions). The cognitive-motor task had two levels of complexity (Easy and Difficult) and all subjects performed at each level for two minutes. While performing this cognitive-motor task, subjects received electrical stimuli to the third and fourth finger of their non dominant hand. The intensity of these stimuli was set by the experimenter at two standard deviations above each subject's threshold. Each subject's threshold was determined through the method of limits (see D'Amato, 1970) prior to the commencement of task performance. Subjects were asked to signal that they had perceived an electrical stimulus presentation by pressing a button placed under their right foot. Both number of detections and reaction time to stimuli detection were recorded during three measurement periods: Baseline (during which subjects were not involved in performing the cognitive-motor task), and during completion of the Easy and Difficult Versions of the cognitive-motor task.

Therefore, the design of Study 4 can be conceptualized as a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) x 3 (Measurement Periods or Levels of Task Complexity: Baseline/Easy/Difficult), with the last factor being a repeated measures factor.

6.1.3.2 Subjects' characteristics and their recruitment

Subjects participating in Study 4 were selected from among a group of 105 Australian public servants who responded to the second recruitment drive for male volunteers, aged between 20 and 60 years, to participate in psychological research. Recruitment was carried out in a similar manner as that described in relation to earlier studies. However, different government departments were targeted. As was the case with the first recruitment drive, potential subjects were offered measures of their estimated aerobic capacity and percentage body fat in exchange for participation in a study ostensibly investigating "the effect of fitness on the performance of cognitive tasks". Contrary to the previous recruitment drive, potential subjects were informed that they might be required to attend the laboratory on two occasions. This request resulted from the use of the same subject population in Studies 4 and 5, and the fact that, as explained in greater detail in Chapter 7, Study 5 required subjects to be tested on two separate occasions.

The descriptive data for the population of individuals who volunteered in response to the second recruitment drive is presented in Table 6.1. This table also presents descriptive data for the 48 subjects selected for participation in Study 4.

Table 6.1
Means and standard deviations for age and the four subscales of the Form C of the JAS for the total volunteer population and the selected subject sample

	Total Volunteer Population				Selected Sample		
	Mean	SD	Range	N	Mean	SD	N
JAS (Form C) Subscales							
Type A	214.29	61.26	103 - 373	105	220.37	80.27	48
Speed & Impatience	161.57	56.81	33 - 306	105	160.77	64.74	48
Hard-Driving & Comp.	106.55	25.86	50 - 175	105	106.89	27.66	48
Job Involvement	229.33	43.50	131 - 337	105	233.56	41.48	48
Age							
Years	29.54	8.22	20.04 - 58.98	105	27.91	6.36	48

A comparison of Table 6.1 (above) and Table 4.1 (see Chapter 4) shows that the descriptive data for the 105 individuals who returned completed questionnaires in the second recruitment drive, is similar to that of the group of 83 volunteers who responded to the first recruitment drive. Mean Type A score and age, however, were somewhat lower for volunteers in the second recruitment drive. This result appears to be related to the fact that 29 of these volunteers were under the age of 25 years, while no such persons volunteered in response to the first recruitment drive. Furthermore, 16 of the volunteers from the second recruitment drive were employed in Division Four of the Australian Public Service, while no such persons volunteered in response to the first recruitment drive. The remaining subjects were employed in Divisions Two and Three, with the main body of volunteers coming from Division

Three. Given that occupational seniority has been found to be related to the manifestation of the TABP (see Byrne and Reinhart, 1989), the inclusion of less senior employees in the second recruitment drive may have contributed to lowering the mean Type A score. Nonetheless, the mean Type A score of the present volunteer population is very similar to the respective mean score for the WCGS population on which the JAS was standardized (see Jenkins et al., 1979).

Classification of subjects' behaviour type was carried out with the Form C of the JAS (Jenkins et al., 1979 - see Appendix A.1). In order to select for participation relatively extreme scorers on the JAS, this instrument was mailed to all 105 volunteers prior to the commencement of the study. Subjects were classified as Type A or Type B according to whether their JAS Type A scores were above one half of one standard deviation or below one half of one standard deviation, respectively, from the volunteer population mean. As noted in Chapter 4, this classification procedure was undertaken in an attempt to ensure accurate subject classification.

Forty-eight subjects (24 Type As and 24 Type Bs), who were classified as Type A or Type B using the procedure described above, were selected for participation in Study 4. As can be appreciated from Table 6.1, these 48 subjects had a mean age of 27.91 years (SD = 6.36). The mean age for the selected Type A subjects was 29.09 years (SD = 7.80), while the mean age for the selected Type B subjects was 26.72 years (SD = 4.34). The difference between these means was not significant, $t(46) = 1.30$, $p = .199$. Table 6.1 also presents the mean JAS subscale scores and standard deviations for the selected subject sample.

6.1.3.3 Materials and apparatus

The cognitive-motor task which subjects were asked to perform involved two modified versions of the Digit Symbol Substitution (DSS) subtest of the WAIS (Wechsler, 1955). One of these versions required a test sheet very similar to that used in Study 1. This time, however, no five letter words were included in the DSS test sheet. This version, which from here on will be referred to as the 'Difficult Version', contained the standard 9 number-symbol pairs placed in the top half of the DSS test sheet. In the bottom half of the Difficult Version of the DSS test sheet there were a total of eight rows of 25 numbers each. The numbers ranged from 1 to 9 and all numbers appeared on the test sheet with approximately the same frequency. During task performance, subjects were asked to write the matching symbol for each number in a box below each digit. The Difficult Version of the DSS test sheet is presented in Appendix D.1.

The second version of the DSS test sheet used in Study 4, represented a less demanding task than that posed by the Difficult Version of the DSS test sheet. The Easy Version consisted of only three number-symbol pairs placed in the top half of the test sheet with eight rows of 25 numbers each in the bottom half. This arrangement represented an easier task because there were only three numbers to be encoded rather than nine as was the case in the Difficult Version. The three numbers presented in the Easy Version of the DSS task were 1, 4, and 7. The Easy Version of the DSS test sheet can be found in Appendix D.2.

Subjects' pre-task training for the DSS task, took place on a separate training sheet similar to that used in Study 1. This training sheet contained the nine number-symbol pairs and one row of 25 numbers, which subjects used to familiarize themselves with the task. The DSS training sheet can be found in Appendix A.2.

Electrical stimuli were produced by a shock generator modified to permit regulation of stimulus intensity in milliamps. Subjects received the electrical stimuli through two heavy duty plate electrodes strapped with velcro around the tips of the third and fourth finger of their non dominant hand. The shock generator was connected to a reaction timer, so that presentation of electrical stimuli triggered the onset of reaction time measurement. Subjects were asked to respond to the electrical stimuli by using their right or left foot to press a button on a foot rest placed under the table on which subjects worked during the DSS task. The pressing of this button caused the reaction timer to stop. If the subject failed to respond to the stimuli within 5 seconds, the timer returned to the 'ready' position for the next trial.

6.1.3.4 Procedure

6.1.3.4.1 General

All subjects were tested individually in a sound deadened and temperature controlled laboratory. The temperature was kept between 20 and 22°C. Upon arrival at the laboratory subjects were seated in a comfortable office chair and were allowed 10 minutes to acclimatize to room temperature. Subjects were seated in front of a drafting table. Both the chair and the table were adjusted to suit subjects' leg extension and writing position. This allowed them to comfortably rest their feet on the foot rest under the table where the response button was located.

Once the 10-minute acclimatization period had elapsed, subjects were informed that prior to their participation in a cognitive task and the estimation of their aerobic capacity, they would be required to undergo a procedure designed to ascertain whether they were able to perceive "some very subtle tingling sensations" in their fingertips. It was explained that this procedure was also related to the investigation of the effects of fitness on the performance of mental tasks. Specifically, subjects were told that the experimenter was interested in ascertaining whether fitness affected subjects ability to perceive subtle sensations delivered to the body. Subjects were reassured that the stimuli to be delivered to their fingertips were weak and hardly perceptible. At this point, subjects were given the opportunity to terminate their involvement in the study if they so wished. It should be noted that no subject elected to do so.

Heavy duty plate electrodes were then strapped around the fingertips of the subjects' third and fourth fingers of the non dominant hand. Subjects were then told that the experimenter would be delivering "weak tingling sensations" through the electrodes. Subjects were instructed to respond to the tingling stimuli in their fingertips by pressing the button on the foot rest. Furthermore, subjects were informed that the experimenter was interested not only on whether they could detect an electrical stimulus, but also how quickly they became aware of its presentation. Therefore, they were instructed to respond to each "tingling" electrical stimulus presentation as soon as they became aware of it. Following these instructions, the experimenter ensured that the electrodes were firmly secured and asked subjects to keep their non dominant hand still and resting, palm up on the table in front of them. Subjects were then given a demonstration of the tingling stimuli which they could expect to experience. This demonstration consisted of delivering two, one second electrical stimuli, at low, but perceptible intensities. Once the demonstration of electrical stimuli was completed, subjects were asked to practice pressing the response button with whichever foot they felt more comfortable and with whichever foot they could guarantee a fast response.

Once subjects had familiarized themselves with the response button, they were told that next they would be asked to respond to weak electrical stimuli of different intensities. Before leaving the room, the experimenter checked the electrodes once again and reminded subjects to keep their non dominant hand still and resting palm up.

6.1.3.4.2 Method of Limits Phase

The experimenter then left the room and positioned himself in a separate room from which he had a view of the subject through a one way mirror and from which he had control of the shock generator and reaction timer. A method of limits procedure (see D'Amato, 1970) was then commenced so as to establish the intensity threshold at which subjects could perceive the electrical stimuli. This threshold value was to be later used in 'individualizing' the stimulus intensity at which subjects' response latencies and detection rate were to be tested during the baseline and task phases of Study 4.

Pilot testing in a group of 20 male undergraduate university students revealed that there was great variability in threshold for perception of electrical stimuli. In the pilot study, subjects' threshold for electrical stimuli was in the 0.295 to 0.715 milliamps range. For the method of limits procedure in Study 4, a range of stimuli was selected within the pilot study's range and above and below this range, so that for each subject the higher intensity levels would be clearly above threshold and the lower intensity levels would be clearly below threshold. The stimulus intensities used during the method of limits procedure were also selected so that there were constant and relatively small differences in intensity. With the above considerations in mind, subjects in the method of limits phase of Study 4 were exposed to a set of electrical stimulus intensities ranging from 0.100 to 1.000 milliamps in steps of 0.025 of a milliamp and of 1 second's duration at approximately 10 seconds apart.

Following D'Amato's (1970) description of the method of limits technique, stimuli were presented in trials of decreasing and increasing order, starting from a point where the stimulus intensity was judged to be well above the subject's threshold. Every time a subject failed to detect a stimulus intensity, a plus sign was entered on the threshold data sheet in the appropriate column and the experimenter proceeded to deliver the next stimulus intensity. This procedure was continued until the experimenter delivered a stimulus intensity which the subject failed to perceive, in which case a minus sign was entered in the threshold data sheet and the first decreasing trial was terminated. The first increasing trial was then commenced starting from a point where the stimulus intensity was judged to be well below the subject's threshold. If the subject failed to detect the stimulus presented at that intensity, a minus sign was entered in the threshold data sheet and the experimenter delivered the next stimulus intensity. This procedure continued until the subject was able to detect a stimulus intensity, in which case a plus sign was entered in the appropriate column and the first increasing trial was terminated. In total, 10 (5 decreasing and 5 increasing) trials were carried out for each subject.

The same stimulus intensity was not always used to start all decreasing or increasing trials. According to D'Amato (1970), this step is necessary because beginning all decreasing trials with the same stimulus intensity may allow subjects to estimate that on all these trials, approximately the same number of positive responses intervene between the beginning of a trial and the threshold. This may then be used by subjects to estimate the threshold location. It should also be noted that during the method of limits phase, reaction times were not recorded. Instead, plus and minus signs were recorded if subjects responded or failed to respond, respectively, to a stimulus within five seconds of its presentation.

Table 6.2

Mean absolute thresholds (in milliamps) for electrical stimuli delivered to the fingertips of the third and fourth fingers of the non dominant hand of Type A and Type B subjects subsequently allocated to the Challenge and No Challenge Conditions

	Behaviour Type Groups					
	Type A			Type B		
Conditions	Mean	SD	Range	Mean	SD	Range
Challenge	0.341	0.136	0.157 - 0.650	0.286	0.069	0.136 - 0.404
No Challenge	0.334	0.117	0.195 - 0.572	0.350	0.114	0.157 - 0.504
Type Means	0.337	0.124	0.157 - 0.650	0.318	0.098	0.136 - 0.504

Note: For each behaviour type group N = 24. For each behaviour type-conditions cell n = 12.

The threshold for each trial was calculated by finding the mid point between the two values over which the response reversal occurred (i.e., the mid point between the values where plus signs changed to minus and viceversa). The absolute threshold for the entire series of 10 trials was obtained for each subject by calculating the mean threshold value for the 10 trials. Table 6.2 presents the mean thresholds obtained by Type A and Type B subjects who were subsequently allocated to the Challenge and No Challenge Conditions. A statistical comparison revealed that the mean thresholds exhibited by Type A and Type B subjects were not significantly different, $t(46) = 0.59$, $p = .555$.

6.1.3.4.3 Baseline Phase

The previously mentioned pilot study revealed that an electrical stimulus with an intensity of two standard deviations above each subject's threshold was reliably and consistently detected by all subjects when not distracted by other tasks. However, when having to perform a concurrent task (namely the Easy and Difficult Versions of the DSS task), subjects exhibited a deterioration of their response latencies to this stimulus and even failed to detect some presentations of this stimulus. This observation suggested to the author that a similar experimental design could be used to test whether Type A and Type B subjects would differ in the consistency and speed with which they could detect physical sensations as a function of the complexity of external environmental demands and the importance or challenge inherent in external environmental stimuli. Of particular interest was the investigation of whether Type A and Type B subjects' threshold for noticing physical sensations would be differentially elevated by the demands imposed on attention capacity by the complexity and ego challenging qualities of external stimuli.

In order to establish whether Type A and Type B subjects' threshold for noticing physical sensations was differentially affected by task complexity and the manipulation of ego challenge, it was necessary to first determine a baseline from which to judge any possible changes in response latency and consistency of stimulus detection. Therefore, following the method of limits phase, subjects were required to respond to 8 presentations of the electrical stimulus at an intensity of two standard deviation units above each subject's individual absolute threshold. As would be recalled, the absolute threshold for each subject was the mean value yielded by the 10 method of limits trials. In deriving the intensity at which subjects' responses were to be studied, not only was the subject's individual mean taken into account, but also his individual standard deviation for the 10 method of limits trials. For example, if a subject had obtained an absolute threshold of 0.450 milliamps and a standard deviation of 0. 015 milliamps over the 10 method of limits trials, the intensity at which he was tested during the remainder of the study (i.e., baseline and task periods) was two standard deviation units above threshold, which in this hypothetical case would be 0.480 milliamps. The use of individualized stimuli was implemented as a way of ensuring that each subject would receive subjectively similar physical sensations, which would make between subject comparisons of response latencies and detection rates a more valid procedure.

It is important to note that during the baseline period, subjects were not given any instructions other than the experimenter informing them that they would be required to respond to "tingling" sensations in their fingertips by pressing the response button as quickly as possible. Subjects were also instructed that the stimuli would be presented randomly in time within a two minute period, the commencement and the end of which would be signalled by a soft tone. They were then given a demonstration of this tone. Subjects were not informed of the number of stimulus presentations, nor the intensity at which these stimuli were to be delivered. Before leaving the room to commence the baseline procedure, the experimenter checked that the electrodes were securely attached and reminded subjects to keep their non dominant hand still and palm up.

During the two-minute baseline period, a total of eight electrical stimuli, with an intensity of two standard deviations above each subject's threshold, were presented at time intervals ranging from 10 to 25 seconds. Each stimulus presentation was of one second's duration. As noted earlier, every time a stimulus was presented this triggered the reaction timer, which was stopped by the subject's pressing of the response button. When this occurred, the experimenter recorded the successful detection of the stimulus and the response latency displayed by the reaction timer.

Consistent with the pilot study, all subjects in Study 4 were able to detect all 8 presentations of the electrical stimulus (at two standard deviation units above threshold) during the baseline period.

6.1.3.4.4 Task Phase

Following the completion of the baseline phase of Study 4, the experimenter entered the testing room carrying with him the DSS training sheet and the Easy and Difficult Versions of the DSS task sheet. At this point, subjects were informed that they were required to perform a "cognitive task involving the processing of symbols and numbers". Subjects were told that this part of the study was also related to the experimenter's objective of investigating the effects of fitness on the performance of mental tasks and they were informed that estimation of aerobic capacity would take place following the completion of the cognitive task. Subjects were then shown the DSS training sheet and the task requirements were explained. Following a brief practice on the DSS training sheet, Challenge Condition subjects were told in an informal 'chatty' manner; "it looks like you've got the general idea, it is really straight forward once you get the hang of it,...you wouldn't think so, but this test is in fact a test of intelligence, which is used by various American universities as part of their selection procedures. Apparently, it correlates well with the way people perform at university. Anyway, if you are interested, I will tell you how you went at the end of the intelligence test". No Challenge Condition subjects were simply told that they had done well in the practice sheet, and the experimenter always referred to the DSS task as a "cognitive task" rather than as an intelligence test which was diagnostic of ability.

Following delivery of the instructions mentioned above, the DSS training sheet was withdrawn and the Easy and Difficult Versions of the DSS task sheet were placed face down on the table in front of the subject. The Easy Version was placed next to the subject, while the Difficult Version was placed on the opposite side of the table, but within reach of the subject. All subjects, regardless of condition, were then instructed that there were two parts to the "cognitive task" or the "intelligence test" (depending on experimental condition) and that one part was easier than the other. The experimenter then pointed to the two task sheets lying face down on the table and informed subjects that each part was to be completed separately. Subjects were then instructed that on hearing a soft tone, like the one used in the previous phase of the study, they should turn over the task sheet which was in front of them and start working as fast and as accurately as possible. They were told that the object of the task was to complete as many symbol-number pairs as possible within a two-minute period. All subjects were also instructed that at the end of this two-minute period, the soft tone would be presented once again to notify them to stop working on that part of the "cognitive task" or "intelligence test" (depending on experimental condition) and start working on the other part. Specifically, they were told that on hearing the second soft tone, they should put aside the task sheet on which they had been working up to that point and immediately turn over the other task sheet. They were also informed that a third soft tone would be presented at the end of a further two-minute period to notify them that they should stop working altogether.

The experimenter then alerted all subjects that during their performance of the "cognitive task" or "intelligence test" (depending on the experimental condition) they would be receiving "tingling" sensations in their fingertips similar to the ones they received during earlier stages of the study, and that these sensations would be presented randomly during the four minutes of task performance. All subjects, regardless of condition, were asked to respond to these sensations, as soon as they became aware of them, by pressing the response button. However, they were reminded to work as fast and accurately as possible in the DSS task. Before leaving the room the experimenter checked that the electrodes were firmly secured, and reminded subjects to keep their non dominant hand still and wait until they heard the first soft tone to commence working.

It should be noted that subjects were not informed of the number or intensity of stimuli to be presented during task performance. Furthermore, subjects were not forewarned of the difference between the Easy and Difficult Versions of the DSS task, nor were they forewarned as to which version they were to perform first. In reality, all subjects received a total of 16 stimulus presentations at an intensity of two standard deviation units above their individual thresholds. Of these, 8 were presented during the two-minute period in which subjects were completing the Easy Version of the DSS task, while the remaining 8 presentations took place during the two minutes of Difficult DSS task performance. As was the case during the baseline phase, task phase stimuli were of 1 second's duration and presented at intervals ranging from 10 to 25 seconds. In order to minimize the possibility of artificial errors in the detection of electrical stimuli (as a consequence of the physical activity involved in changing the task sheet), care was taken to ensure that no electrical stimuli were presented during the last 10 seconds of Easy DSS task performance or the first 10 seconds of Difficult DSS task performance. Finally, it should be noted that half of the subjects within each of the behaviour type-condition cells performed the Easy Version of the DSS task first and the Difficult Version of the DSS task second, while the opposite was the case for the remaining subjects. The experimenter recorded subjects' response latencies to stimulus presentations. Failures to detect these presentations were also recorded every time subjects failed to respond within 5 seconds.

After completing four minutes of DSS task performance, subjects rested for 10 minutes before undergoing a bicycle ergometer test to estimate their aerobic capacity. Following this test, they were asked to return to the laboratory another day on the pretext that reliable estimates of aerobic capacity could only be obtained after two sessions. The reason for this procedure is related to Study 5 and therefore is explained in detail in Chapter 7. It should be noted here, however, that subjects were not debriefed as to the nature of Study 4 until they had completed the tasks required of them during their second attendance at the laboratory.

6.1.4 Results

6.1.4.1 Number of electrical stimulus presentations detected

The number of electrical stimulus presentations detected by each subject was computed for each of three measurement periods. These were the two-minute baseline period, the two-minute period of Easy DSS task performance, and the two-minute period of Difficult DSS task performance. Table 6.3 presents the mean number of electrical stimulus presentations detected by Type A and Type B subjects in the Challenge and No Challenge Conditions during these three measurement periods. All subjects, regardless of condition or behaviour type, were able to detect all electrical stimulus presentations during the baseline period. However, as can be seen from Figure 6.1 and Table 6.3, all subject groups were unable to maintain a perfect detection rate during performance of both the Easy and Difficult Versions of the DSS task.

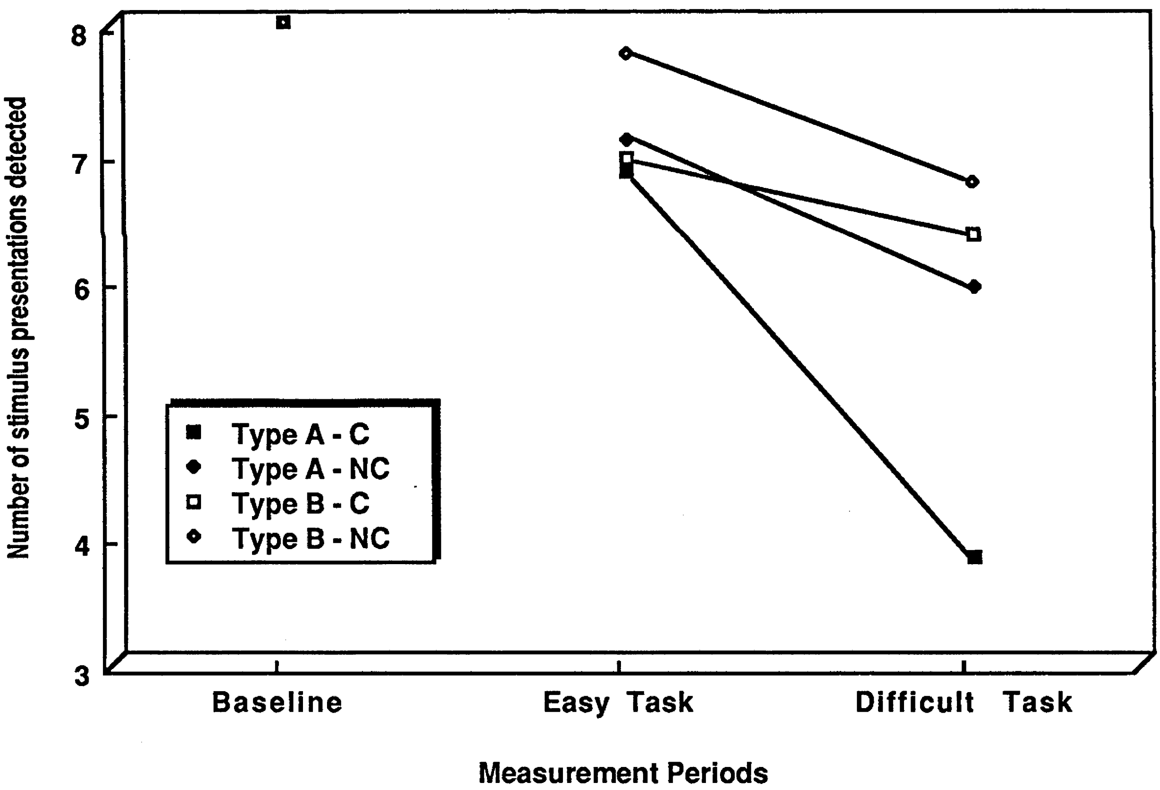

Figure 6.1

Graphical representation of mean number of electrical stimulus presentations detected by Type A and Type B subjects in the Challenge (C) and No Challenge (NC) Conditions, as a function of performing no primary task (baseline) and as function of performing Easy and Difficult primary tasks. For each behaviour type-condition cell n = 12.

Table 6.3

Mean number and percentage of electrical stimulus presentations detected during baseline and performance of the Easy and Difficult Versions of the DSS task by Type A and Type B subjects in the Challenge and No Challenge Conditions

	Behaviour Type Groups					
	Type A			Type B		
	Measurement Periods			Measurement Periods		
Conditions	Baseline	Easy Task	Difficult Task	Baseline	Easy Task	Difficult Task
Challenge	8	6.83	3.83	8	6.92	6.33
		(1.80)	(2.55)		(1.38)	(2.22)
	100%	85.4%	47.9%	100%	86.5%	79.1%
No Challenge	8	7.08	5.92	8	7.75	6.75
		(1.38)	(2.31)		(0.62)	(1.48)
	100%	88.5%	74.0%	100%	96.9%	84.4%
Type - Task Complexity Cell Means	8	6.95	4.87	8	7.33	6.54
		(1.57)	(2.61)		(1.13)	(1.86)
	100%	86.9%	60.9%	100%	91.6%	81.7%

Note: Standard deviations are presented in brackets. Standard deviation values for the baseline period were 0.00 in all conditions because all subjects were capable of detecting the stimuli presented when not distracted. There were eight electrical stimulus presentations during each measurement period. For each behaviour type group N = 24. For each behaviour type-condition cell n = 12.

In order to check for possible between groups differences in the deterioration (from baseline) of the detection of electrical stimulus presentations, it would have been desirable to analyze the relevant data in terms of a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) x 2 (Measurement Periods or Levels of Task Complexity: Easy/Difficult - repeated measures factor) analysis of covariance with baseline detection as the covariate. However, given the ceiling or near ceiling levels of detection (particularly during baseline and performance of the Easy Version of the DSS task), analysis of covariance of the detection data was not advisable because of the possibility that ceiling levels may produce distorted error terms. A possible alternative analysis was the calculation of slopes and the comparison of such slopes between groups. This procedure was also inadvisable, because it assumes equadistance between points on the x axis, something which could not reasonably be assumed with respect to the points of baseline, Easy DSS task, and Difficult DSS task.

It was decided that a possible way of evaluating whether Type A and Type B subjects differed in their detection of electrical stimulus presentations as a function of DSS task complexity and challenge, was to compare the number of subjects from each behaviour type group who were capable of detecting a certain number of stimulus presentations within each of the four challenge condition-task complexity cells. This required a series of Chi-square analyses in which the likelihood that Type A and Type B subjects would detect half or less (i.e., 4 or less) or more than half (i.e., 5 to 8) of the stimulus presentations made during each of the two task complexity levels, in each of the challenge conditions, was evaluated. Selection of the 50% criterion for dividing groups was thought to represent a conservative test of between-types differences in the detection of electrical stimulus presentations, but one that was necessary given the method of data analysis employed.

As can be appreciated from Table 6.4, only 1 Challenge Condition subject from each behaviour type group detected 4 or less electrical stimulus presentations during the performance of the Easy Version of the DSS task, while the remaining 22 (11 Type A and 11 Type B) Challenge Condition subjects were capable of detecting 5 or more stimulus presentations during this level of DSS task complexity. As would be expected from the figures listed above, the Chi-square analysis of subject frequencies within the Challenge Condition-Easy Task Complexity cell revealed no significant between-types difference in the number of subjects who detected 5 or more electrical stimulus presentations, χ^2 (1, N = 24) = 0.01, p = 1.000.

Table 6.4 also lists the frequency of Type A and Type B No Challenge Condition subjects who detected four or less electrical stimulus presentations or 5 or more of these presentations during performance of the Easy Version of the DSS task. As can be seen on this table, during performance of the Easy Version of the DSS task, only 1 Type A No Challenge Condition subject detected 4 or less of the electrical stimulus presentations, while the remaining 11 Type A No Challenge Condition subjects detected between 5 and 8 of the electrical stimulus presentations. On the other hand, all 12 Type B No Challenge Condition subjects detected more than half (i.e., between 5 and 8) of the electrical stimulus presentations made during the Easy Version of the DSS task. The Chi-square analysis for these subject frequencies failed to reveal a significant between-types difference, χ^2 (1, N = 24) = 1.04, p = .307.

Table 6.4

Number of Type A and Type B Challenge and No Challenge Condition subjects who detected half or less (i.e., 4 or less) of electrical stimulus presentations or more than half (i.e. 5 to 8) of these presentations during the Easy and Difficult Versions of the DSS tasks

	Behaviour Type Groups			
	Type A		Type B	
Conditions and Levels of Task Complexity	Detected 4 or less	Detected 5 or more	Detected 4 or less	Detected 5 or more
Challenge Condition				
Easy DSS Task	1	11	1	11
Difficult DSS Task	7	5	2	10
No Challenge Condition				
Easy DSS Task	1	11	0	12
Difficult DSS Task	3	9	2	10

Note: There were 8 presentations of an electrical stimulus during each level of task complexity. For each behaviour type group N = 24. For each behaviour type-condition cell n = 12. Task complexity was a repeated measures factor.

A significant between-types difference in the ability to detect electrical stimulus presentations were revealed by analysis of subject frequencies within the Challenge Condition-Difficult Task Complexity cell. As illustrated by Table 6.4, only 5 of the Type A Challenge Condition subjects detected 5 or more of the electrical stimulus presentations made during the Difficult Version of the DSS task. On the other hand, 10 Type B Challenge Condition subjects detected 5 or more of the electrical stimulus presentations made during the performance of the Difficult Version of the DSS task. Chi-square analysis of these subject frequencies yielded a significant result, indicating that Type A Challenge Condition subjects were more likely than their Type B counterparts to fail to detect at least half of the electrical stimulus presentations made during performance of the Difficult Version of the DSS task, χ^2 (1, N = 24) = 4.44, p = .035.

The significant between-types difference observed in subject frequencies with respect to the Challenge Condition-Difficult DSS Task Complexity cell was not repeated in the No Challenge Condition-Difficult DSS Task Complexity cell. As noted in Table 6.4, this cell contained 3 Type A and 2 Type B subjects who detected 4 or less of the electrical stimulus presentations, while 9 Type As and 10 Type Bs detected more than half of these presentations. As would be expected from these subject frequencies, a Chi-square analysis revealed no significant between-types difference, χ^2 (1, N = 24) = 0.25, p = .615.

The results yielded by the Chi-squares listed above indicate that only under conditions of salient ego challenge or threat (i.e., Challenge Condition) and taxing cognitive task demands (i.e., Difficult Version of the DSS task), were Type As more likely than Type Bs to fail to detect at least half of the electrical stimulus presentations. Given that analysis of variance procedures could not be used to analyse the detection data and the conservative nature of the division of subjects in the Chi-square analyses, it is possible that subtle between-types differences in the detection of electrical stimulus presentations in the No Challenge Condition or during the Easy Version of the DSS task could have gone undetected.

In view of the observations above, it was decided to test whether a less conservative division of subjects would yield significant between-types differences under conditions presenting other than a combination of ego challenging instructions and taxing task demands. Therefore, subjects were divided into those who detected 7 or less electrical stimulus presentations and those who detected all 8 presentations. The number of Type A and Type B subjects in each of the four condition-task complexity cells are presented in Table 6.5.

Chi-square analyses of subject frequencies for the Challenge Condition-Easy DSS Task Complexity, No Challenge Condition-Easy DSS Task Complexity, and No Challenge Condition-Difficult DSS Task Complexity cells are shown in Table 6.5. These analyses revealed no significant between-types differences, χ^2 (1, N = 24) = 0.01, p = 1.000; χ^2 (1, N = 24) = 1.81, p = .178; χ^2 (1, N = 24) = 1.81, p = 0.178, respectively. However, the Chi-square analysis of subject frequencies within the Challenge Condition-Difficult DSS Task Complexity cell revealed a significant between-types difference, indicating that Type B subjects were more likely than Type As to detect all

8 electrical stimulus presentations, χ^2 (1, N = 24) = 5.04, p = .025. Therefore, despite making the division of subjects more sensitive to possible subtle between-types differences in the detection of electrical stimulus presentations, the Challenge Condition-Difficult DSS Task Complexity cell remained the only cell in which Type B subjects were more likely than Type As to detect presentations of the electrical stimuli.

Table 6.5

Number of Type A and Type B Challenge and No Challenge Condition subjects who detected 7 or less electrical stimulus presentations or all 8 presentations during the Easy and Difficult Versions of the DSS tasks

	Behaviour Type Groups			
	Type A		Type B	
Conditions and Levels of Task Complexity	Detected 7 or less	Detected 8	Detected 7 or less	Detected 8
Challenge Condition				
Easy DSS Task	6	6	6	6
Difficult DSS Task	11	1	6	6
No Challenge Condition				
Easy DSS Task	1	11	2	10
Difficult DSS Task	10	2	7	5

Note: There were 8 presentations of an electrical stimulus during each level of task complexity. For each behaviour type group N = 24. For each behaviour type-condition cell n = 12. Task complexity was a repeated measures factor.

Instances in which subjects incorrectly pressed the response button when no electrical stimulus presentation had been made were rare and on average only occurred 0.375 and 0.083 times for Type A and Type B subjects respectively, while performing the Easy Version of the DSS task, and 0.291 and 0.001 times respectively, when performing the Difficult Version of the task. These observations are important because they suggest that subjects were not responding randomly (i.e., without clear detection of the presentation of the electrical stimulus).

At the completion of DSS task performance, subjects were asked whether having perceived a "tingling sensation", they had at any stage opted not to respond to it or were "too busy" to respond to it. Two subjects (one Type A and one Type B) admitted to this, with one noting that failure to respond may have occurred on one occasion, while the other reported that this had occurred twice. This anecdotal observation is important because it suggests that in general, failures to respond to electrical stimulus presentations may not have been due to a conscious decision not to make a response, but rather to a failure to process (or become aware of) the physical sensations associated with the presentation of the electrical stimulus.

6.1.4.2 Reaction time to electrical stimulus presentations

Response latencies to electrical stimulus presentations during the baseline period were subjected to a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) analysis of variance procedure. This analysis revealed a types effect which approached significance, $F(1,44) = 3.22$, $p = .079$. As can be appreciated from the means presented in Table 6.6, this effect was due to Type A subjects' tendency to respond faster than Type Bs to electrical stimulus presentations made during the baseline period. This analysis failed to reveal any other significant effects or interactions (see Appendix D.3 for the complete analysis of variance table). Therefore, in the absence of distracting challenges or taxing external stimuli, Type A subjects were able to detect and/or respond to the physical sensations produced by the electrical stimulus faster than Type B subjects.

Table 6.6 also presents subjects' mean reaction times to the electrical stimulus presentations made during performance of the Easy and Difficult Versions of the DSS task. In order to check for possible between groups differences in the deterioration (from baseline) of response speed to electrical stimulus presentations during DSS task performance, response speed data were subjected to a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) x 2 (Measurement Periods or Levels of Task Complexity: Easy/Difficult - repeated measures factor) analysis of covariance with baseline response speed as the covariate.

This analysis of covariance revealed a types effect which approached significance, $F(1,43) = 3.34$, $p = .075$. The means displayed in Table 6.6 and the graphical representation of these means in Figure 6.2 indicate that this effect was due to the fact that Type A subjects (regardless of condition) exhibited a greater deterioration (from baseline) of response speed during performance of the Easy and Difficult Versions of the DSS task than Type Bs. In order to give the reader a better indication of the degree of reaction time change from baseline which the different groups exhibited during the Easy and Difficult Versions of the DSS task, mean change reaction time scores (from baseline) for the periods of Easy and Difficult DSS task performance are presented in Table 6.7.

Table 6.6

Mean reaction time (seconds) to the electrical stimulus presented during baseline and the Easy and Difficult Versions of the DSS task for Type A and Type B subjects in the Challenge and No Challenge Conditions

	Behaviour Type Groups					
	Type A			Type B		
	Measurement Periods			Measurement Periods		
Conditions	Baseline	Easy Task	Difficult Task	Baseline	Easy Task	Difficult Task
Challenge	0.638 (0.163)	0.873 (0.186)	1.060 (0.342)	0.912 (0.457)	0.908 (0.410)	0.951 (0.356)
No Challenge	0.711 (0.303)	0.893 (0.282)	0.997 (0.373)	0.768 (0.282)	0.784 (0.110)	0.866 (0.195)
Type - Task Complexity Cell Means	0.675 (0.241)	0.883 (0.234)	1.028 (0.351)	0.840 (0.379)	0.846 (0.301)	0.908 (0.284)

Note: There were 8 electrical stimulus presentations in each measurement period. If a subject failed to detect a stimulus presentation within 5 seconds of delivery, no reaction time was recorded for that trial. Therefore, values presented in this table represent the mean reaction time for detected stimulus presentations. Standard deviations are presented in brackets. For each behaviour type group N = 24. For each behaviour type-condition cell n = 12.

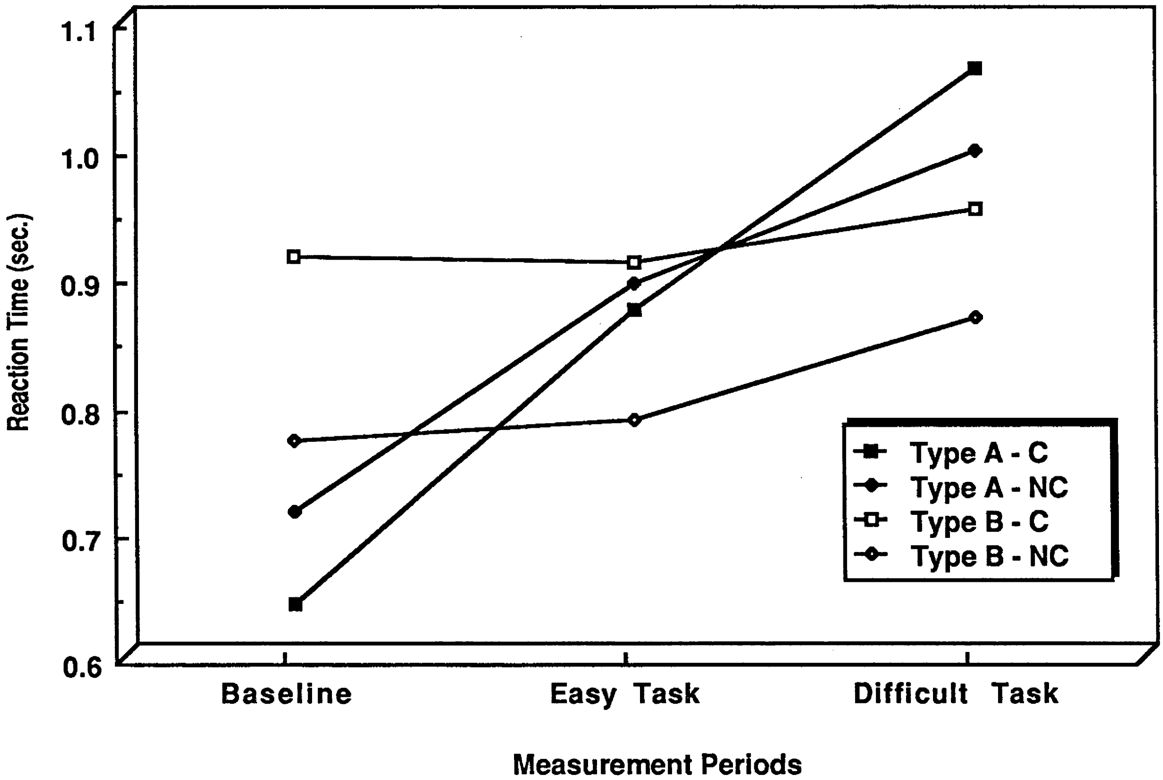

Figure 6.2

Graphical representation of mean reaction times in response to electrical stimulus presentations detected by Type A and Type B subjects in the Challenge (C) and No Challenge (NC) Conditions, as a function of performing no primary task (baseline) and as a function of performing Easy and Difficult primary tasks. For each behaviour type-condition cell n = 12.

The analysis of covariance of reaction time data also revealed a task complexity effect, $F(1,44) = 11.23$, $p = .002$. Examination of the means in Tables 6.6 and 6.7, as well as the graphical representation of these means in Figure 6.2, indicate that this effect was due to the fact that during performance of the Difficult Version of the DSS task, subjects (regardless of behaviour type or condition) experienced a greater deterioration in reaction time speed (from baseline levels) than was the case during performance of the Easy Version of the DSS task. The complete analysis of covariance table is presented in Appendix D.4.

Table 6.7

Mean change reaction time (from baseline) for the periods of Easy and Difficult DSS task performance for Type A and Type B Challenge and No Challenge Condition subjects

	Behaviour Type Groups					
	Type A			Type B		
	Reaction Time Change from Baseline Period to:			Reaction Time Change from Baseline Period to:		
Conditions	Easy Task Period	Difficult Task Period	Type - Condition Cell Means	Easy Task Period	Difficult Task Period	Type - Condition Cell Means
Challenge	0.234	0.421	0.327	-0.004	0.039	0.017
No Challenge	0.182	0.286	0.234	0.016	0.098	0.057
Type - Task Complexity Cell Means	0.208	0.354	0.281	0.006	0.068	0.037

6.1.4.3 DSS (primary) task performance

Subjects' performance in the Easy and Difficult Versions of the DSS task was quantified in terms of the number of digit and symbol pairs which they correctly completed within each of the two-minute task performance periods. These data were subjected to a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) x 2 (Measurement Periods or Levels of Task Complexity: Easy/Difficult - repeated measures factor) analysis of variance. This analysis revealed a significant task complexity effect, $F(1,44) = 562.10$, $p < .001$. Examinations of the means in Table 6.8 indicates that this effect was due to the fact that subjects (regardless of behaviour type or condition) completed a greater number of digit and symbol pairs when having to contend with the processing of 3 of these pairs (in the Easy Version of the DSS task) than when having to process 9 of these pairs (in the Difficult Version of the DSS task).

No other significant effects or interactions were found. The complete analysis of variance table for DSS task performance data can be found in Appendix D.5.

Table 6.8
Means for performance in the Easy and Difficult Versions of the DSS task for Type A and Type B Challenge and No Challenge Condition subjects

	Behaviour Type Groups					
	Type A			Type B		
Conditions	Easy DSS Task	Difficult DSS Task	Total DSS Tasks	Easy DSS Task	Difficult DSS Task	Total DSS Tasks
Challenge	149.17 (27.61)	83.42 (18.16)	232.59 (44.31)	138.83 (25.34)	84.42 (12.27)	223.25 (34.28)
No Challenge	138.25 (32.65)	84.08 (18.57)	222.33 (49.74)	129.17 (16.60)	72.75 (9.47)	201.92 (23.29)
Type - Task Complexity Cell Means	143.71 (30.09)	83.75 (17.97)	227.46 (46.36)	134.00 (21.52)	78.58 (12.26)	212.58 (30.80)

Note: Standard deviations are presented in brackets. For each behaviour type group N = 24. For each behaviour type-condition cell n = 12.

6.1.5 Discussion

It was hypothesized that Type A subjects exposed to an ego challenging (important) primary task, would fail to detect as many electrical stimulus presentations as Type A subjects not exposed to ego challenging instructions and Type B subjects in general. It was also hypothesized that, for Type A subjects, the detrimental effect of ego challenging instructions on the detection of electrical stimuli would be exacerbated by primary task complexity. The results of Study 4 yielded partial support for these hypotheses. It should be noted, however, that the inability to use parametric analyses prevented the adequate investigation of effects and interactions.

The non parametric statistical analyses conducted revealed that Type A and Type B subjects were equally likely to detect electrical stimulus presentations under conditions of no ego challenge and regardless of whether external stimuli were easy or difficult. Contrary to expectations, no significant difference was observed in the number of Type A and Type B Challenge Condition subjects detecting half or less of the electrical stimulus presentations made during performance of the Easy Version of the DSS task. This suggests that, if the external environmental demands confronting Type As are relatively simple, ego challenging situational characteristics may not be sufficient to lead Type As to allocate attention maximally to the external environment (at the expense of task-peripheral internal stimuli). It may be that, in situations which Type As perceive as being easily controllable (as may have been the case during performance of the Easy Version of the DSS task), they may not feel challenged or threatened by experimental instructions regarding the diagnostic value of the task at hand.

Consistent with expectations, Type A Challenge Condition subjects were found to be more likely than their Type B counterparts to fail to detect at least half of the electrical stimulus presentations made during performance of the Difficult Version of the DSS task. This observation indicates that both primary task difficulty and ego challenging instructions may be important situational characteristics in eliciting between-types differences in the processing of task-peripheral physical sensations.

Similar hypotheses as those formulated in regards to the detection of electrical stimulus presentations were made with respect to the response latency data. These data, however, permitted the use of parametric statistical analyses. These analyses revealed that during the Easy and Difficult Versions of the DSS task, Type A subjects (regardless of condition) exhibited a deterioration of reaction time to electrical stimuli (from baseline levels) which was significantly greater than that exhibited by Type Bs.

Analysis of the reaction time data did not reveal a conditions effect nor types by conditions or types by task complexity interactions. This suggests that neither ego challenge nor task complexity manipulations led to between-types differences in response speed deterioration.

It is interesting to note that there was a task complexity effect, which confirms that manipulation of task complexity had its predicted detrimental effect on the speed of processing of task-peripheral physical sensations.

In summary both the detection data and the response latency data provided evidence which indicates that during the DSS task, Type A subjects may have exhibited restricted processing of task-peripheral physical sensations. However, while the response latency data revealed that Type A subjects, regardless of condition or task difficulty, experienced greater deterioration of response speed than Type Bs, analysis of the detection data indicates that only under conditions of ego challenge and exposure to complex external stimuli, Type As were more likely than Type Bs to fail to detect a considerable number of electrical stimulus presentations.

It could be argued that the above observations indicate that even in the absence of ego challenging instructions and complex external stimuli Type A subjects may have been more sensitive to the competitive nature of the experimental situation and thus allocated attention to the DSS task to a greater extent than did Type Bs. This allocation of attention may have been sufficient to cause Type As to process task-peripheral electrical stimulus presentations relatively more slowly than did Type Bs across both Challenge and No Challenge Conditions and both levels of task complexity.

However, it could be argued that it was only under conditions of salient ego challenge and exposure to taxing (difficult) external stimuli, that Type A subjects allocated attention capacity to the primary task to the extent that they completely failed to detect electrical stimulus presentations. Type A subjects' failure to detect physical sensations during exposure to complex and ego challenging (important) external stimuli is consistent with Pennebaker's observation that the processing of physical sensations is inversely related to the availability for processing of complex and/or important external stimuli (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980).

If one considers that, in Study 4, each subject received subjectively comparable levels of stimulation which controlled for individual differences in threshold, the finding that Type A subjects are less likely than Type Bs to detect electrically induced physical sensations cannot be attributed to between-type differences in the objective intensity of internal stimuli available for processing. This further supports the hypothesis that during exposure to ego challenging (important) and complex external stimuli Type A subjects may have exhibited an elevation in their threshold for noticing physical sensations.

Consistent with the above hypothesis, Type A and Type B subjects were shown to be able to detect electrical stimulus presentations during a baseline period and during this period Type As responded to electrical stimulus presentations faster than Type Bs. This further suggests that during DSS task performance (and as a consequence of the allocation of processing capacity to important and complex external stimuli), Type A subjects may have experienced a greater elevation in their threshold for noticing task-peripheral physical sensations than Type Bs.

This hypothesized elevation in Type A subjects' threshold for noticing physical sensations is consistent with the findings of Study 1. Type A subjects in Study 1 were observed to require HR elevations of a greater magnitude than Type Bs in order to report the heart racing symptom.

Support for the view that the findings of Study 4 represent actual between type differences in the processing of task-peripheral visceral sensations rather than conscious decisions not to respond to these stimuli is provided by anecdotal observations provided by subjects following task completion indicating that they were largely unaware of their failure to respond to electrical stimulus presentations.

The fact that Type A Challenge condition subjects' restricted processing of task-peripheral sensations was not accompanied by superior performance in the primary DSS Difficult task, suggests that their performance did not benefit by their hypothesized extreme allocation of attention to this task. A possible explanation for this finding may be that the association between DSS task performance and attention allocation may be an asymptotic one.

In summary, Study 4 provided evidence for the hypothesis that Type A individuals' symptom under-report may be a manifestation of a situation specific, attention focus mediated phenomenon. This study provided evidence that between-types differences in the detection of physical sensations may be elicited by conditions in which Type A subjects perceive an ego challenge or threat associated with the performance of an activity, and where that activity involves the processing of relatively complex external stimuli. No between-types difference in detection of physical sensations was observed in conditions which failed to combine ego challenging and difficult external stimuli. While there was evidence that even in conditions were ego challenge was subtle and external stimuli less complex, Type As experienced restricted processing of task-peripheral physical sensations, this was not sufficient to cause Type A subjects to fail to detect more electrical stimulus presentations than Type Bs. As noted, this failure only occurred when ego challenge was salient and a difficult task was introduced.

Thus, it would appear that for Type As to focus attention on external stimuli at the expense of task-peripheral physical sensations, these stimuli must be perceived to be relevant to the mastery of an ego challenge or threat (and thus important) and to be relatively complex. Ego challenging instructions in the absence of perceived difficulty may not elicit extreme attention focus on task-relevant aspects of the environment because this situation may not be perceived as a real challenge or threat. The same may be argued about task complexity in the absence of ego challenging instructions. These observations are consistent with the view that, as a defense strategy, Type A individuals may choose to ignore challenges or threats that are not highly salient (see Glass, 1977)

In Study 4 physical sensations were produced by artificial means and subjects were forewarned that they would experience these sensations during their performance of a primary task. This permitted a degree of control over task-peripheral stimuli but meant that Study 4 was not a direct test of the role of attention allocation in the incidental processing of actual symptoms. Chapter 7, reports on an attempt to test this in a more direct manner.

CHAPTER 7

7.1 Introduction: Study 5

Study 4 (see Chapter 6) provided evidence that Type A individuals may exhibit restricted processing of task-peripheral physical sensations in conditions where they are exposed to relatively complex external stimuli and processing of these stimuli is perceived as important in successfully mastering an ego challenge or threat. This observation is consistent with the hypothesis that, motivated by a need to do well in a task which they perceive as posing an ego challenge or a threat to personal control or failure, Type A individuals may focus their attention on those aspects of the environment which are relevant to successfully mastering this challenge or threat, at the expense of task-peripheral stimuli such as symptoms (see Weidner and Matthews, 1978).

Furthermore, the above observation is consistent with Pennebaker's model of symptom perception (Pennebaker, 1982, 1983, Pennebaker and Lightner, 1980), which suggest that the availability for processing of complex and important external stimuli is inversely related to the processing of internal stimuli. Within this model, Type A subjects who perceive certain external stimuli as posing an ego challenge, the possibility of failure and/or threatening personal control, would be less likely to process changes within the body than Type Bs who are hypothesized to be less concerned with these challenges or threats (see Chapter 1 - Section 1.5).

The observation that in Study 4 only the condition combining complex and ego challenging or threatening external stimuli elicited restricted processing of, and an elevated threshold for noticing task-peripheral physical sensations is consistent with the situation specific manifestation of other Type A responses (see Chapter 1 - Section 1.3 and 1.5 and Chapter 2 - Section 2.2.3) and with the conceptualization of the TABP as a response set elicited from susceptible individuals by appropriately challenging environmental stimuli (see Burke and Weir, 1980; Friedman and Rosenman, 1971, 1974; Jenkins, 1976; Glass, 1977; Matthews, 1982).

In summary, the results of Study 4 appear to support the hypothesis that Type A individuals' symptom under-report may be mediated by situationally elicited restricted processing of task-peripheral visceral stimuli. However, this support was indirect: as noted earlier, the task-peripheral physical sensations investigated in Study 4 were artificially induced and subjects were forewarned as to their occurrence during performance of a primary task. Therefore, the findings of Study 4 may not be directly relevant in elucidating the role of attention allocation in the incidental processing of actual symptoms.

7.1.2 Objectives of Study 5

Study 5 attempted to evaluate in a more direct manner, the role of attention allocation in the incidental processing of actual symptoms. This study was designed to investigate the relationship between the complexity and ego challenge (importance) inherent in the external environment and the incidental processing and report of actual symptoms by Type A and Type B subjects. This meant, however, that a somewhat less reliable method for controlling the intensity of task-peripheral physical sensations across subjects had to be employed than that implemented in Study 4 (naturally occurring symptoms being more difficult to control than electrically induced physical sensations) and that the report of these task-peripheral sensations had to be measured by retrospective post-task ratings (in order not to influence subjects' naturally occurring level of attention to symptoms during task performance).

In summary, like Study 4, Study 5 aimed to test the effects of external stimuli complexity and ego challenge or threat in the processing of physical sensations. However, the sensations investigated in Study 5 were actual physical responses rather than artificially induced physical sensations.

In designing Study 5, one of the major difficulties facing the author was to find a method for exercising control over the intensity of task-peripheral physical sensations, without artificially inducing these sensations (as was the case with the electrical stimulus in Study 4). It was desirable to exercise control over the intensity of physiological reactions available to subjects for processing, just as the physical sensations produced by electrical stimuli in Study 4 were controlled by individualized intensity settings (which took into account each subject's threshold). However, physiological reactions arise from within the subject and therefore tend to be out of the control of the experimenter. Control over the intensity of physical reactions was judged necessary, if each subject was to have relatively similar potential subjective experiences which would facilitate the comparison of symptom report patterns across behaviour type groups and conditions.

It was decided to designed Study 5 in such a way as to control the extent to which subjects were exerted while exercising on a bicycle ergometer. This was done by asking subjects to work for a set period of time, with a load that was estimated to tax 50% of each subject's aerobic capacity. This procedure has been found to result in comparable subjective experiences of exertion across individuals (see Astrand and Rodahl, 1977; Borg, 1971).

In order to investigate the influence of external stimuli complexity and importance on the processing of actual physical reactions, while exercising on the bicycle ergometer subjects were required to perform cognitive tasks which varied in terms of complexity and the extent of ego challenge or threat that was associated with their unsuccessful completion.

The experimental manipulations describe above were derived from Pennebaker's work in the area of attention allocation and symptom report (see Pennebaker,1982, 1983; Pennebaker and Lightner, 1980). As will be recalled, this researcher suggests that the processing of symptoms is inversely related to the availability for processing of complex, important, and novel external stimuli. Pennebaker specifically hypothesizes that if two individuals have comparable internal sensory information available to them, the one in the more demanding, important, and/or interesting external environment will be less likely to process internal sensations than the individual in an undemanding or uninteresting situation (see Pennebaker,1982, 1983; Pennebaker and Lightner, 1980).

Consistent with this hypothesis, Pennebaker and Lightner (1980) found that when physical exertion was held constant during exercise on a treadmill, subjects hearing interesting and varied sounds reported less fatigue and fewer symptoms than subjects hearing an amplification of their own breathing, and than control subjects who received no distraction manipulation. Furthermore, Pennebaker and Lighter (1980) found that subjects jogging equal length cross-country and lap courses evidenced faster times on the former. Pennebaker and Lighter (1980) interpreted this finding by suggesting that during the performance of the cross-country run, subjects focussed their attention on external factors to a greater extent than in the lap run, thus restricting the processing of internal sensations. This reasoning is based on the assumption that a cross country run is more cognitively demanding and interesting than the lap course, given the obstacles to be found in a cross country course and its variety of scenery. Pennebaker and Lightner (1980) concluded that subjects ran the cross country course faster than the lap course because the cross country run restricted the monitoring and processing of internal sensations, which in turn allowed subjects to increase their pace without feeling maximally fatigued.

Pennebaker and Lightner's (1980) research provides a precedent for the investigation of the processing of exercise-induced symptoms as a function of the complexity and importance of the external environment. It was based on this precedent that external stimuli complexity and importance was manipulated during physical exercise in Study 5.

7.1.2 Hypotheses

The hypotheses formulated with respect to Study 5 were similar to those formulated with respect to Study 4 and were based based on Pennebaker's model of symptom processing (see Pennebaker,1982, 1983; Pennebaker and Lightner, 1980) and findings concerning Type A individuals' susceptibility to psychosocial challenges and threats (see Chapter 1 - Sections 1.3, 1.5 and Chapter 2 - Section 2.2.3). Specifically, the reasoning behind the formulation of hypotheses was that since processing of physical sensations is inversely related to the complexity and importance of external stimuli available for processing at any given time (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980), Type A individuals who are concerned with and are hyper-responsive to ego challenges and/or threats (e.g., Holmes et al., 1982; Malcom et al., 1984), should respond to external stimuli which are perceived as important in mastering an ego challenge or threat by focussing attention on these stimuli at the expense of task-peripheral bodily changes.

The following hypotheses were formulated:

(1) Based on Pennebaker's model of symptom perception (Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980), it was hypothesized that all subjects (regardless of behaviour type) would tend to process and report fewer and less intense exercise-induced symptoms in the High Distraction Condition (which involved performance of a complex cognitive task under ego challenging instructions) than in the Moderate Distraction Condition (which also involved performance of a complex cognitive task, but presented without challenging instructions), and in the Low Distraction Condition (which involved performance on a very simple, non taxing, and predictable light detection task presented without challenging instructions).

(2) More importantly a types by conditions interaction in symptom report was also predicted. It was reasoned that ego challenge associated with performance on a complex cognitive task would elicit between-types differences in the extent to

which subjects would allocate processing capacity to external task-relevant stimuli and internal task-peripheral stimuli (i.e., exercise-induced symptoms). It was hypothesized that Type A High Distraction Condition subjects would allocate a greater proportion of processing capacity to cognitive task-relevant stimuli at the expense of task-peripheral (exercise-induced) symptoms. This pattern of attention allocation was expected to lead Type A High Distraction Condition subjects to: (a) report fewer and less intense exercise-induced symptoms; (b) rate their work load as being lighter; and (c) report to have monitored their bodies less frequently than Type B subjects in general (who are less concerned with ego challenges and /or threats) and Type A subjects in the Moderate and Low Distraction Conditions (who were not subjected to the combination of ego challenge and complex external stimuli).

(3) As was the case in Study 4, it was reasoned that in the absence of ego challenging instructions, Type A subjects may also exhibit more restricted processing of task-peripheral stimuli than Type Bs, if the primary task is sufficiently difficult to be perceived as a threat or challenge. Therefore, it was tentatively hypothesized that during performance of a relatively difficult task, in the Moderate Distraction Condition Type A subjects may exhibit poorer detection of, and slower responses to task-peripheral stimuli than when performing a relatively easy task in the Low Distraction Condition and than the Type Bs in general.

It should be noted that at the time of formulating this hypothesis the author was unaware of the results of Study 4.

7.1.3 Method

7.1.3.1 Overview and design

Study 5 consisted of two separate testing sessions, at least one week, and no more than two weeks apart. In the first session, after the completion of procedures related to Study 4, subjects underwent a test of aerobic capacity. Estimations of aerobic capacity derived from work on a bicycle ergometer in session one were later used to calculate, for each subject, the workload that would tax 50% of his aerobic capacity.

In session two, subjects were required to exercise on a bicycle ergometer for a six-minute period (with the work load which had earlier been calculated to tax 50% of each subject's aerobic capacity). The use of 50% work loads served to produce comparable subjective experiences across subjects (see Astrand and Rodahl, 1977; Borg, 1971). During the exercise on the bicycle ergometer in session two, subjects were required to attempt one of two cognitive tasks. The complexity inherent in these cognitive tasks and the level of ego challenge implied in the instructions with which these tasks were introduced represented manipulations of distraction from exercise-induced symptoms. In the High Distraction Condition, subjects were required to complete a difficult problem solving task which was introduced as a sensitive test of intelligence. In the Moderate Distraction Condition, subjects were also required to perform a similarly difficult problem solving task, but were not administered ego challenging instructions. In the Low Distraction Condition, subjects were required to perform a very simple and uninteresting vigilance task which was presented without ego challenging instructions.

At the end of the six-minute combined exercise-cognitive task period, subjects were asked to make retrospective reports of the symptoms which they had experienced during this period. In order to evaluate the effects of distraction manipulations on the processing of symptoms, data were analyzed in terms of a 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction /Low Distraction) experimental design.

7.1.3.2 Subjects' characteristics and their recruitment

Subjects taking part in Study 5 were the same persons who participated in Study 4. Therefore, the descriptive data presented in Table 6.1 (see Chapter 6) are also relevant to Study 5. As will be recalled, 48 subjects were selected for participation in Study 4, from a group of 105 male public servants who volunteered in response to the second recruitment drive. These 48 subjects were classified as Type A or Type B according to whether their JAS (Jenkins et al., 1979) Type A scores were above one half of one standard deviation or below one half of one standard deviation respectively, from the volunteer population mean.

7.1.3.3 Materials and apparatus

In sessions one and two, subjects were required to exercise on a Quinton-Monark bicycle ergometer. This bicycle ergometer has a wheel which is mechanically braked by a belt running around a rim. Both ends of this belt are attached to a revolving drum, to which a pendulum is fixed. This device acts as a pendulum scale, measuring the differences in force at the two ends of the belt. The belt can be stretched by a lever adjusted by a handwheel from the top. The deflection is then read off in a scale graded in kiloponds (Kp). Each revolution of the pedal on the Quinton-Monark bicycle ergometer represents a distance traveled of six metres.

In sessions one and two, subjects were instructed to pedal at 50 revolutions per minute so that for each minute of pedaling subjects would 'travel' 300 meters. In order to help subjects achieve this pedaling rate, the bicycle ergometer was fitted with a speedometer. This speedometer was placed just below eye level, and had a highly visible green marking on its face and a red needle. Subjects were informed that keeping the needle in line with the green marking would ensure a pedaling rate of approximately 50 pedal revolutions per minute. The braking power set by the adjustment of belt tension, multiplied by the distance pedaled, gave the amount of work performed in kilopond metres per minute (kpm/min). The bicycle ergometer was fitted with a cardboard panel above the Kp scale, so that subjects could not ascertain the work load at which they were working. In order to monitor subjects' pedaling rate, the bicycle ergometer was fitted with a battery operated counter which clicked over every time the pedal crossed the field of 'vision' of a sensor.

The Kp scale of the bicycle ergometer comes from its manufacturers with markings indicating every half Kp from 0.500 to 4 Kp. However, in order to accurately allocate workloads that would tax as close as possible to 50% of each subject's aerobic capacity, it was necessary to divide the Kp scale even further so as to indicate every 0.050 Kp. Prior to the commencement of each session, the bicycle ergometer was calibrated using standard weights.

Subjects' weight, height, and oral temperature were measured using commercially available instruments. Skin fold thickness measures were taken using Lange skin-fold calipers (with pressure set at 10 g/mm^2). Blood pressure (BP) was measured using a Copal Digital Sphygmomanometer (model UA-251). Pulse rate was monitored using an ear lobe clip sensor connected to a Sanyo Digital Pulse Meter (model HRM 700E). This measure of pulse rate was used as a way of quickly monitoring subjects' exertion during exercise periods. However, heart rate (HR) was also measured by a bipolar chest lead connected to a two channel Grass polygraph. It was the polygraph recording and not the digital readout from the pulse meter that was used to estimate aerobic capacity.

During the exercise period in session two, subjects worked on one of two cognitive tasks. The cognitive task in the High and Moderate Distraction Conditions was Raven's (1962) Advanced Progressive Matrices Set 2. Raven's Advanced Progressive Matrices were designed as a non verbal test of mental ability. This test consists of 36 problems or puzzles. Each problem or puzzle consists of a large figure from which a part is missing, and the subject is asked to name which of 8 parts presented below the large figure is the missing part. Solution of the problems requires the subject to come up with the best possible fit, which not only involves matching lines and patterns, but determining the structural organization of a series of discrete or abstract symbols. A sample item from Raven's (1962) Advanced Progressive Matrices Set 2 is presented in Appendix E.3. Each of the 36 matrices was photocopied onto overhead transparencies which were projected from behind the subject, onto a screen. The screen was placed one meter in front of the bicycle ergometer on which subjects exercised.

The task in the Low Distraction Condition involved the detection of a light produced by a 40 watt torch bulb placed on a stand facing the subject, one metre from the bicycle ergometer. Subjects were provided with a response button which they could hold in one hand while pedaling. This button was connected to a response latency timer, which served to measure the speed with which subjects detected the onset of the light.

7.1.3.4 Procedure

7.1.3.4.1 General

Upon return of the completed JAS questionnaire, subjects were contacted by telephone and asked whether they had had a history of coronary heart disease (CHD) or high BP, and whether they had ever been told by a medical practitioner to avoid strenuous physical exercise. If the responses to these questions were negative, subjects were then informed that they would be required to attend the laboratory on two separate occasions. If this arrangement was satisfactory, an appointment for the first session was then made, and subjects were informed that they should bring with them sport shoes and clothing. Subjects were also requested not to smoke or eat, and to avoid energetic physical exercise, for at least two hours prior to their attendance at the laboratory. On arrival at the laboratory for the first session, subjects were first asked to complete the procedures discussed in relation to Study 4 (see Chapter 6).

7.1.3.4.2 Session One: Estimation of maximal aerobic capacity

All subjects were tested individually in a temperature controlled laboratory, where temperature was kept between 20 and 22°C.

Upon completion of the procedures involved in Study 4, subjects were informed that the experimenter would proceed to estimate their aerobic capacity. At this point, subjects were asked to remain seated and the experimenter proceeded to establish whether, according to the criteria set by the International Committee for the Standardization of Physical Fitness Tests (ICSPF - see Larson, 1974), each subject was fit to perform submaximal exercise testing. Firstly, subjects were once again asked whether they had ever been advised not to perform strenuous physical exercise, and whether they had ever had a myocardial infarction (MI), angina pectoris, myocarditis, arrhythmia, high BP or diabetes mellitus. Due to the nature of the physical exercise that subjects were asked to carry out, the experimenter required subjects to sign a consent form. It should be noted, however, that the estimation of aerobic capacity in the present study did not involve maximal tests, but rather less demanding submaximal work stress. It should also be noted that as a precaution, during both experimental sessions, a medical practitioner and/or nurse were able to be contacted by internal telephone.

Following the criteria set by the ICSPF, measures of pulse rate and oral temperature were also taken to ensure that resting pulse was below 100 beats per minute and that oral temperature was below 37.5°C. Subjects were also rejected from the test if they had any infectious disease including the common cold and if resting diastolic blood pressure (DBP) and systolic blood pressure (SBP) were above 90 mmHg and 140 mmHg, respectively.

Upon completion of BP measurements, the experimenter proceeded to measure the subject's weight (without street clothes) and height (without shoes). Body fat was also measured using skin-fold calipers. Four skinfold measures were taken at the following sites: triceps (half-way down the arm between the tip of the acromion and the tip of the alecronon, with the fold picked up in a line passing directly up the arm from the tip of the alecronon process), scapula (inferior angle of the scapula with the fold running parallel to the auxiliary border), abdominal (horizontal fold adjacent to the umbilicus), and suprailiac (vertical fold on the crest of the ilium at the midaxillary line). All skinfold thickness measures were made on the dominant side of the body, using the techniques and landmarks described by Wilmore and Behnke (1969).

Upon completion of anthropometric measurements, the experimenter proceeded to secure the bipolar chest lead with one electrode in V_5 position and the other below the left scapula. Subjects were then asked to remain seated for approximately five minutes while the experimenter calibrated polygraph recordings. Once this procedure had been carried out, subjects were invited to sit on the bicycle ergometer and the saddle height was adjusted (so that there was a slight amount of knee flexion, when the pedal was in the lowered position). Subjects were then allowed to exercise without resistance at the pedals for one minute. At the end of this period, a small degree of resistance at the pedals was introduced so as to allow the subject to warm up for a further one minute.

At the conclusion of the warm up period, all subjects were instructed that they would be required to pedal at 50 revolutions per minute and that to help them achieve this pedaling rate they should attempt to keep the red speedometer needle in line with the green marking on the face of the speedometer. At this point, subjects were allowed to practice the pedaling rate. Once subjects were judged to have mastered the required pedaling rate, they were told that the experimenter would gradually introduce a load and that they would be required to pedal at 50 revolutions per minute with that load, for six minutes. They were informed, however, that if they felt chest pains or faint they should stop immediately.

Subjects then underwent submaximal testing of aerobic capacity. Direct measures of maximal aerobic capacity require complex apparatus to analyze inhaled and exhaled air. Obviously, not all researchers have access to this equipment and there are some field situations where direct determination of aerobic capacity is highly impractical. The need for a more easily determined and less expensive measure of maximal aerobic capacity was satisfied by Astrand and Ryhming (1954), who developed a nomogram from which (by extrapolation from HR at submaximal workloads) one can estimate an individual's maximal aerobic capacity. This nomogram was subsequently modified by Astrand (1960), who introduced a correction factor for age. Astrand and Rodahl (1977) helped to simplify the use of this nomogram by providing a table on which a given HR at a given work load can be used to read the subject's maximal oxygen uptake.

Astrand and Rodahl's (1977) table was used in the present study to extrapolate each subject's maximal aerobic capacity from HR and workload. This table is presented in Appendix E.1. For a detailed discussion of the assumptions underlying the use of Astrand's (1960) nomogram and Astrand and Rodahl's (1977) table, the reader is referred to Astrand and Rodahl (1977).

Astrand and Rodahl (1977) indicate that the estimation of maximal aerobic capacity from submaximal workloads is not the method of choice when carrying out scientific investigation. Astrand (1960) determined that the standard error of the method for predicting maximal oxygen uptake from submaximal exercise tests is in the vicinity of 10 percent in relatively well trained individuals and 15 percent for moderately trained individuals. Others, however, have found good agreement between the nomogram method and direct measures of oxygen uptake (e.g., Kavanagh and Shephard, 1976; Rodahl and Issekutz, 1962). Despite the possible limitations of submaximal tests for predicting maximal aerobic capacity from HR and workload, the lack of available complex direct measurement equipment and the low budget nature of the present research forced the author to use the indirect nomogram method for estimating aerobic capacity. The predicted value of maximal aerobic capacity yielded by this method was considered to at least provide the experimenter with a readily obtainable estimate of the cardiovascular fitness of each subject from which to calculate a work load taxing approximately 50% of each subject's aerobic capacity.

In order to use Astrand and Rodahl's (1977) table, it was necessary to ascertain the HR of each subject during different workloads under standard conditions. For this reason, the present author followed the procedures for submaximal test administration described by Astrand and Rodahl (1977). Subjects were asked to complete two submaximal work tests lasting six minutes each. Two work tests were carried out to enhance the accuracy of estimations of maximal aerobic capacity. The first test was conducted with a load of 600 kpm/min (or 100 watts), while the second test was carried out with a load of 900 kpm/min (or 150 watts). There was a 5-minute break between the two 6-minute test periods, so that HR and BP returned to baseline levels before the commencement of the second submaximal test. It should also be noted that during both submaximal test periods, pulse rate and HR were continuously monitored. BP was also measured during the third and sixth minute of each submaximal test period. During both submaximal test periods, subjects' pedaling rate was checked by the experimenter by monitoring the speedometer and a pedal counter. When necessary, subjects were reminded to keep to the required pedaling rate.

At the completion of the two submaximal work tests, all subjects were invited to alight from the bicycle ergometer and were asked to sit on a comfortable chair while pulse rate and blood pressure were monitored until they reached baseline levels. A second appointment was then made for subjects to return to the laboratory, at least one week, but not more than two weeks, from the first session. The second session was justified to subjects in terms of the need to establish the reliability of measures of aerobic capacity. Before leaving the laboratory, all subjects were reminded to avoid eating, smoking, and strenuous physical exercise for at least two hours prior to their second session.

It should be noted that subjects were not given any feedback about estimated fitness levels. This step was taken not only to promote subjects' attendance to the second session, but also to ensure that knowledge about fitness levels would not affect symptom report during session two.

Upon subjects' departure from the laboratory, the experimenter proceeded to extrapolate from HR and workload each subject's maximal aerobic capacity. In order to do this, the experimenter used polygraph recordings of HR to calculate each subject's HR during the fifth and sixth minute of work with each of the two submaximal work loads. The mean value of the HR at the fifth and sixth minute was designated as the working HR for the work load in question. This procedure followed the well established observation that a working time of about 5 or 6 minutes is sufficient to adapt the HR to the task being performed (see Astrand and Rodahl, 1977). The working HR for each work load was then used in conjunction with the relevant work load to find the subject's estimated maximal oxygen uptake in Astrand and Rodahl's (1977) table (see Appendix E.1.) . For example, as can be appreciated from Appendix E.1, a working HR of 142 bpm for the 600 kpm/min (or 100 watts) work load would yield a maximal oxygen uptake of 2.5 litres per minute (litres $\cdot$ min^{-1}). This value would then be corrected for age by multiplying it by the age correction factors provided by Astrand and Rodahl (1977). These age correction factors are presented in Appendix E.2. If the two work loads administered yielded different estimations of maximal oxygen uptake, the mean between the two values was taken as the subject's maximal oxygen uptake.

Once the subject's maximal aerobic capacity had been estimated, it was necessary to calculate the level of work required to tax 50% of each subject's maximal aerobic capacity, in preparation for the second session. The procedures for doing this were derived from Astrand and Rodahl (1977) and adopted on the advice of sport physiologists at the Australian Institute of Sport. To facilitate underestanding of the procedures employed, these are presented graphically in Figure 7.1. The experimenter graphically established for each subject, the individual relationship between HR at the different submaximal work loads and the predicted corresponding oxygen uptake (see V_{O2} scale in Figure 7.1). The estimated maximal oxygen uptake was then used to construct a parallel scale which showed the work load expressed as a percentage of the individual's maximal aerobic capacity. HR was subsequently used to assess the approximate oxygen uptake during work as well as the work load expressed as a percentage of the subject's maximal aerobic capacity. As can be appreciated from Figure 7.1, by drawing a straight vertical line from the V_{O2} scale (at the point of 50% capacity) to the work load scale, the experimenter could then ascertain the load necessary to tax approximately 50% of each subject's maximal aerobic capacity. For a more detailed explanation of the assumptions underlying the use of these procedures, the reader is referred to Astrand and Rodahl (1977).

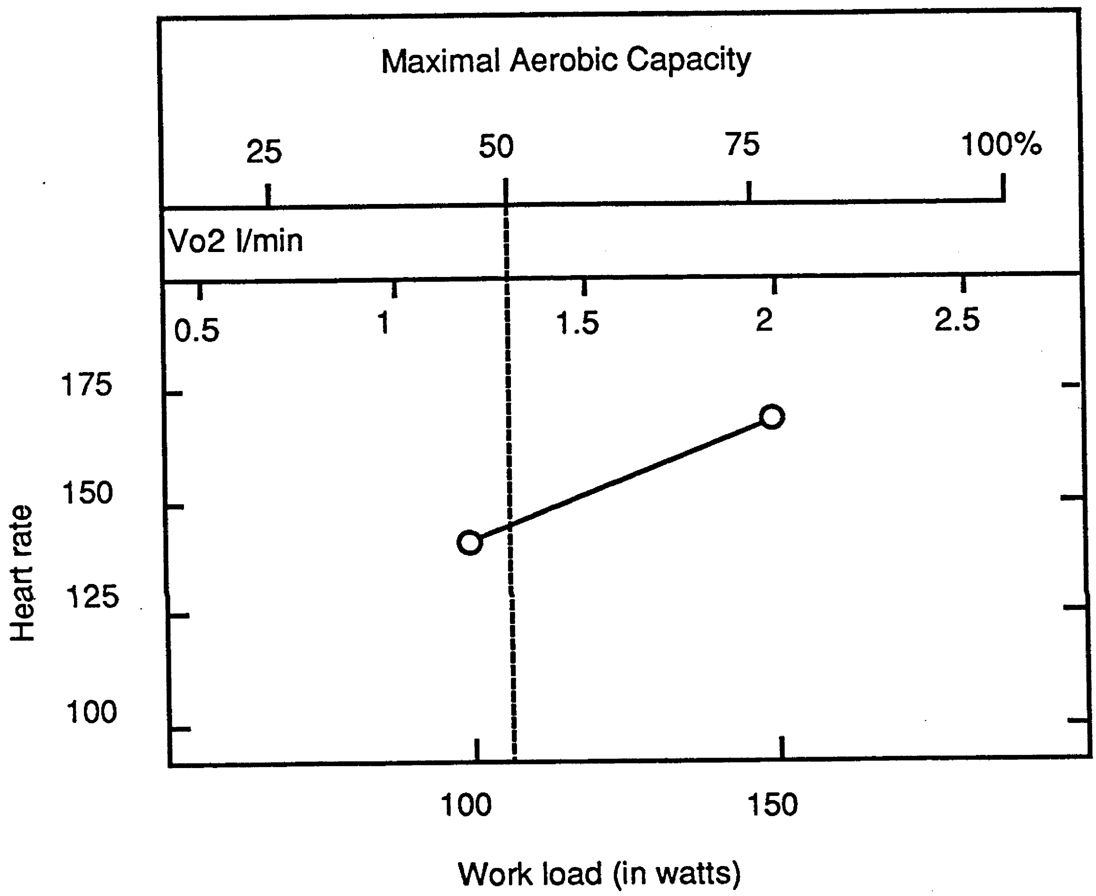

Figure 7.1
Graphical representation of the procedures employed in estimating the work load required to tax approximately 50% of each subject's maximal aerobic capacity (derived from Astrand and Rodahl, 1977, p 456).

7.1.3.4.2 <u>Session Two: combined exercise-cognitive task period</u>

Upon arrival at the laboratory for the commencement of session two, subjects were once again required to sign a consent form. Subsequently, resting measures of pulse rate, BP, and oral temperature were taken. The experimenter then proceeded to place the electrodes on the subject's chest in a similar fashion as that described in relation to session one. The subject was then asked to remain seated for approximately 5 minutes while the experimenter calibrated polygraph recordings. Upon completion of calibration, the saddle of the bicycle ergometer was adjusted and the subject was then invited to sit on the bicycle ergometer. Similar warming up procedures as described in relation to session one were undertaken.

Upon completion of the warming up period subjects were given for the first time different sets of instructions according to their allocation to one of three conditions of distraction from exercise-induced symptoms. Before describing these instructions, it is important to note that subjects were allocated to one of the three distraction conditions on a random basis. The only prerequisite imposed was due to the participation of the same subjects in Studies 4 and 5. Out of concern for the possible carry over effect of subjects having been allocated to either the Challenge or No Challenge Condition in Study 4, it was thought necessary to ensure that in Study 5 there were equal numbers of Type A and Type B Challenge and No Challenge Condition subjects in the three distraction conditions. For this reason, 4 Type A and 4 Type B subjects allocated to the Challenge Condition in Study 4, were now allocated to the High Distraction Condition in Study 5. Similarly, equal numbers of Type A and Type B Challenge Condition subjects were allocated in Study 5 to the Moderate and Low Distraction Conditions. A similar allocation strategy was implemented for Type A and Type B No Challenge Condition subjects. Therefore, in Study 5 there were 16 subjects (8 Type As and 8 Type Bs) in each of the three distraction conditions.

Before the commencement of work on the bicycle ergometer, subjects in the High Distraction Condition were informed that this time, the experimenter wished not only to ascertain the reliability of the aerobic capacity estimates derived from the first session, but also to investigate the effects of physical exercise on the performance of a "very complex intellectual task". Subjects were instructed that during the exercise period on the bicycle ergometer, they would be required to perform a test of intelligence which would be projected onto a screen in front of them. At this point, they were shown a sample item from Raven's (1962) Advanced Progressive Matrices Set 2 and were instructed as to the nature of the task. Furthermore, High Distraction Condition subjects were instructed that they should try to solve "as many problems as possible, as accurately as possible" and that their answers should be communicated to the experimenter by naming out loud the number of the option which they thought to be correct. High Distraction Condition subjects were also informed that for each item they had 40 seconds in which to provide an answer, and that if they failed to provide an answer within this time period, the item would be removed from the screen and a different one would be projected. If the answer was provided before the 40 second period had elapsed, a new problem was immediately projected onto the screen. High Distraction Condition subjects were also informed that each correct response would receive one point, while each incorrect response would incur a one point penalty. These subjects were also told that, if desired, at the completion of the exercise period they would be given feedback as to their performance on the "intelligence test".

Moderate Distraction Condition subjects were also presented with problems from Raven's (1962) Advanced Progressive Matrices Set 2. However, they were simply told that the experimenter was interested in the effects of exercise on the performance of a mental task. These subjects were not given any instructions emphasizing the difficulty or the diagnostic ability of the task. Furthermore, Moderate Distraction Condition subjects were not instructed to work fast or told that points would be deducted for incorrect responses. These subjects were allowed to work on each matrix for as long as they required in order to provide an answer.

Subjects allocated to the Low Distraction Condition were instructed that during the exercise period on the bicycle ergometer, they would be required to perform a simple light detection task. At this point, they were shown a torch light facing them at a distance of one metre and were instructed that "all" they were required to do was to press a response button every time the light came on. This task was justified to subjects in terms of the experimenter's interest in how information processing was affected by the performance of physical exercise. The light stimulus was presented 20 times, at regular intervals of 30 seconds during the 6-minute task period. The light remain on until the subject signalled its detection. The reason for making the light appear at regular intervals was to make the light detection task even more uninteresting, predictable, and undemanding.

Upon the delivery of instructions, all subjects were asked to begin pedaling at the rate of 50 pedal revolutions per minute. Subsequently, the work load calculated to tax 50 percent of each subject's maximal aerobic capacity was introduced. However, subjects were unaware that this load was calculated to tax a certain percentage of their capacity. During the 6-minute combined exercise-cognitive task period, the experimenter sat behind the subject, from where he had control of the projector and the onset of the torch light. The experimenter was also able to continuously monitor HR and pulse rate. As a precaution, the experimenter also measured BP during the third and sixth minutes of task performance. Finally, the experimenter also monitored the pedaling rate and advised subjects as necessary.

At the completion of the 6-minute combined exercise-cognitive task period, the resistance at the pedals was gradually reduced and all subjects were allowed to gradually come to a stop. Subsequently, all subjects were asked to descend from the bicycle ergometer and were required to sit on a comfortable chair while pulse rate and BP were monitored. Once pulse rate and blood pressure had reached resting levels, all subjects were asked to complete a series of questionnaires. The first of these was a 10-item symptom checklist headed by instructions to indicate the extent to which they had experienced each of the symptoms during the exercise period (see Appendix E.5) Symptoms were rated on a 7-point linear scale, on which 1 represented no symptom and 7 represented severe symptom. Subjects were also asked to rate how "heavy" they felt the load (with which they had worked during the second session) to be. This was done by presenting subjects with Borg's (1962) Ratings of Perceived Exertion Scale. This scale consists of 15 grades from 6 to 20 with odd values anchored with verbal expressions such as "very very light" (for grade 6) and "very very heavy" (for grade 19). This scale has been widely used by researchers interested in the psychological aspects of physical exercise to investigate the factors which mediate differences in the subjective experience of exertion (e.g., Borg, 1971; Borg, Egerman, Freeman, and Gust, 1969; Borg and Linderholm, 1967; Ekblom and Goldberg, 1971; Linderholm, 1967; Skinner, Borg, and Buskirk, 1969). A copy of Borg's (1962) Ratings of Perceived Exertion Scale can be found in Appendix E.4.

In order to ascertain whether distraction manipulations had caused subjects in the different conditions to attend to physical stimuli to different extents, they were asked to rate on 7-point scales (with end points labeled "not at all" and "very often") how often, while exercising, they had become aware of the reaction of their bodies (e.g., perspiration, pain, HR or sore muscles), and how often they had thought about how heavy the load felt. These scales can be found in Appendix E.9. As a further manipulation check, subjects were also asked to rate on 7-point scales, how difficult and interesting the matrices or the light perception task (depending on condition) had been. These scales can be found in Appendices E.6 to E.8.

Upon completion of the ratings mentioned above, subjects were fully debriefed and were given an estimation of their maximal oxygen uptake and percentage body fat. Furthermore, subjects were given an explanation of what these measures implied and where they stood in respect of the general population.

7.1.4 Results

7.1.4.1 Anthropometric characteristics of Type A and Type B subjects

As can be seen on Table 7.1, Type A and Type B subjects did not differ significantly in height, but a significant between-types difference was found for body weight. This reflected the fact that Type A subjects, with a mean weight of 75.300 kg, were reliably heavier than Type B subjects, who had a mean weight of 68.699 kg. This difference was not judged to have affected subjects' exertion during the second session on the bicycle ergometer, because work loads for that session were calculated taking into account subjects' maximal aerobic capacity.

Based on the body weight and height data, two indices of body size were calculated. Firstly, a general impression of body stoutness was derived from the Ponderal Index. This index is based on the observation that weight is the result of the three-dimensional expansion of the body. Therefore, if weight and body length are compared, it is necessary to compare the total body length with the cube root of the weight. The Ponderal Index is determined by the following equation:

$$\sqrt[3]{\text{weight, Kg}}/\text{Total body length, cm} \times 100.$$

A thorough explanation of this index is given by Hirata and Kaku (1968). Secondly, an index of body mass, the Quetelet Index (see Bray, 1978), was also calculated. The Quetelet Body Mass Index was obtained from the formula:

$$\text{Weight}/\text{Height}^2$$

Consistent with the observation that Type As were of relatively the same height as Type Bs but somewhat heavier than Type Bs, the former were found to exhibit greater Quetelet Index and Ponderal Index values than the latter. It should be noted that the mean Quetelet Index for both behaviour type groups fell within Bray's (1978) classification of acceptable weight. Once again it should be pointed out that between-types differences in both the Quetelet and Ponderal Indexes were not considered to have affected the extent to which subjects were exerted during the second session because, each subject's maximal aerobic capacity was taken into account when setting his work load.

Table 7.1
Anthropometric characteristics of Type A and Type B subjects

	Behaviour Type Groups			
Measures	Type A	Type B	t value	P
Body Weight (kg)	75.300 (7.229)	68.699 (7.841)	3.03	.004
% Body Fat	13.52 (1.78)	12.70 (2.69)	1.25	.219
Height (cm)	178.40 (5.18)	176.73 (7.19)	0.92	.362
Ponderal Index	2.37 (0.08)	2.32 (0.09)	2.03	.049
Quetelet Index	23.72 (2.32)	21.99 (2.19)	2.65	.011
Max V_{O2} (litres · min^{-1})	3.335 (0.576)	3.167 (0.558)	1.02	.311
Max V_{O2} kg · bw	44.48 (7.92)	46.49 (8.63)	-0.84	.406

Note: For each behaviour type group N = 24. Degrees of freedom for all t values = 46. Standard deviations are presented in brackets.

Percentage body fat was estimated from the skin fold data using Yuhasz's (1962) equation:

5.783 + 0.153 (triceps skinfold + scapula skinfold + abdominal skinfold + suprailiac skinfold).

As can be appreciated from Table 7.1, no significant between-types difference in percentage body fat was found.

Max V_{O2} expressed in litres · min^{-1} was calculated as described earlier by extrapolation from HR and work load (see Appendix E.1). The values obtained from this table were adjusted for age by using the age correction factors in Appendix E.2. Max V_{O2} per kilogram of body weight (Max V_{O2} · bw) was derived by the following formula:

Max V_{O2}, ml/Body weight, Kg

As can be observed from Table 7.1, no significant between-types differences for either Max V_{O2} litres · min^{-1} or Max V_{O2} · bw were observed.

7.1.4.2 Symptom report

Subjects' ratings in the 10-item symptom checklist were added up so as to obtained a total symptom report score. These scores were then subjected to a 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction) analysis of variance (see Appendix E.10). This analysis revealed no significant types effect, $F(1,42) = 2.32$, $p = .135$, and no significant conditions effect, $F(2,42) = 2.05$, $p = .141$. However, there was a significant types by conditions interaction, $F(2,42) = 3.34$, $p = .045$. Since the objective of the present investigation had been to ascertain whether, in terms of symptom report, behaviour type classification would interact with complexity and ego challenge associated with external stimuli, it was decided to investigate the above mentioned interaction by a posteriori comparisons between all pairs of type-condition cell means. These means are presented in Table 7.2.

Newman-Keuls procedures revealed that Type A subjects in the High Distraction Condition reported less symptoms than any other group of subjects. No significant differences between other type-condition cell means were found. For all comparisons between pairs of type-condition cell means, the differences between the means was required to exceed 3.55 in order to reach the .05 level of significance.

The results of these a posteriori comparisons indicate that the types by conditions interaction was due to the fact that Type A subjects in the High Distraction Condition reported significantly fewer and less intense symptoms than their Moderate and Low Distraction Condition counterparts and than Type Bs in general. This observation is consistent with the hypothesis that Type A subjects may exhibit restricted processing of task-peripheral physical sensations while exposed to complex external stimuli which are perceived as posing a challenge or threat to the ego and/or personal control.

The observation that the symptom report of Type A subjects in the Moderate distraction condition did not differ from that of their Low Distraction Condition counterparts and that of Type Bs in general, indicates that contrary to expectations, task complexity on its own (i.e., without ego challenging instructions) is not sufficiently challenging to elicit restricted processing of physical sensations from Type A individuals. This is consistent with the findings of Study 4.

Table 7.2
Mean total reported symptoms for Type A and Type B subjects in the High, Moderate, and Low Distraction Conditions.

	Behaviour Type Group		
Conditions	Type A	Type B	Condition Means
High Distraction	15.63 (3.42)	23.13 (4.76)	19.38 (5.57)
Moderate Distraction	23.13 (6.71)	22.50 (4.63)	22.81 (5.58)
Low Distraction	22.13 (5.84)	21.88 (4.02)	22.00 (4.84)
Type Group Means	20.29 (6.26)	22.50 (4.31)	

Note: The total symptom scores presented in this table are the sum of the ratings of 10 individual symptoms, each rated on a 7-point scale, where 1 = no symptom and 7 = severe symptom. Standard deviations are presented in brackets. For each behaviour type group N = 24. For each behaviour type-condition cell n = 8.

The a posteriori comparisons described above also revealed that, within the Type B group, manipulations of task difficulty and ego challenge did not influence symptom report. This suggests that in the presence of complex external stimuli and ego challenging instructions Type B subjects may have processed physical sensations to the same extent as in the presence of less complex or challenging external stimuli. Although Type B individuals were expected to be less sensitive to ego challenging instructions than Type As, they would have been expected to at least exhibit the effects of task difficulty in their symptom report, consistent with Pennebaker's model of symptom perception (see Pennebaker, 1982, 1983, Pennebaker and Lightner, 1980). This model predicts that in the general population task difficulty would be inversely related to the processing of physical sensations. The reason why this effect was not evident within the Type B group in Study 5 is not clear.

7.1.4.3 Auxiliary data

7.1.4.3.1 Ratings of work load

Subjects' ratings of work load were also subjected to a 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction) analysis of variance. This analysis revealed a significant types effect, $F(1,42) = 4.25$, $p = .045$. The means presented in Table 7.3 indicate that this effect was due to the fact that Type A subjects rated their work load as being lighter than did Type Bs, regardless of condition. This is inconsistent with the hypothesis that Type A subjects would report less exertion than Type Bs only in conditions involving complex and important external stimuli.

No significant condition effect was observed in subjects' ratings of work load, $F(2,42) = 0.54$, $p = .588$. This observation is also inconsistent with the hypothesized inverse relationship between external stimulus complexity and importance, and the processing of physical sensations (see Pennebaker, 1982, 1983, Pennebaker and Lightner, 1980).

It should also be noted that, contrary to what was the case with the symptom data, analysis of work load ratings failed to reveal a types by conditions interaction, $F(2,42) = 0.50$, $p = .612$. This finding is inconsistent with the hypothesis that between-types differences in the processing of internal stimuli would be mediated by the complexity and importance of external stimuli. The complete analysis of variance table for ratings of work load is presented in Appendix E.11.

Table 7.3

Mean ratings of perceived exertion (work load) for Type A and Type B subjects in the High, Moderate, and Low Distraction Conditions.

	Behaviour Type Groups		
Conditions	Type A	Type B	Condition Means
High Distraction	12.63 (1.85)	13.25 (1.83)	12.94 (1.81)
Moderate Distraction	12.75 (1.67)	13.50 (2.07)	13.13 (1.86)
Low Distraction	11.63 (1.60)	13.38 (1.41)	12.50 (1.71)
Type Group Means	12.33 (1.71)	13.38 (1.71)	

Note: Ratings of perceived exertion (work load) were made on Borg's (1962) Ratings of Perceived Exertion Scale. This scale consists of 15 grades from 6 to 20 with odd values anchored with verbal expressions such as "very very light" (for grade 6) and "very very heavy" (for grade 19). Standard deviations are presented in brackets. For each behaviour type group N = 24. For each behaviour type-condition cell n = 8.

7.1.4.3.2 Self-reports of attention allocation to physical sensations and work load

Subjects' ratings of how frequently they had attended to the work load and physical reactions arising from this work load were subjected to 2 (types A/B) x 3 (distraction conditions: High/Moderate/Low distraction) analyses of variance.

The analysis of data concerning subjects' self reported frequency of attention to the work load, revealed no significant effects of interactions. However, as can can be

Table 7.4

Self reported frequency of attention to work load and physical reactions by Type A and Type B subjects in the High, Moderate, and Low Distraction Conditions

Conditions	Behaviour Type Groups: Type A	Behaviour Type Groups: Type B	Condition Means
High Distraction			
How often attended to work load	1.75	2.50	2.13
	(0.71)	(0.53)	(0.72)
How often attended to bodily reactions	2.25	2.37	2.31
	(0.89)	(1.06)	(0.95)
Moderate Distraction			
How often attended to work load	1.87	2.87	2.38
	(0.99)	(3.12)	(1.09)
How often attended to bodily reactions	3.37	3.50	3.44
	(1.51)	(1.07)	(1.26)
Low Distraction			
How often attended to work load	2.87	2.75	2.81
	(1.36)	(1.67)	(1.47)
How often attended to bodily reactions	3.00	4.12	3.56
	(1.77)	(1.46)	(1.67)
Type Group Means			
How often attended to work load	2.17	2.71	
	(1.13)	(1.12)	
How often attended to bodily reactions	2.87	3.33	
	(1.45)	(1.37)	

Note: All ratings were made on 7-point scales, on which 1 = not at all and 7 = very often. Standard deviations are presented in brackets. For each behaviour type group N = 24. For each behaviour type-condition cell n = 8.

appreciated from Table 7.4, there was a non significant trend for Type A subjects in general to report attending less to how heavy the load felt than did other subjects. Furthermore, within the Type A group there was a non significant tendency for High Distraction condition subjects to report attending less to the work load than their Moderate and Low Distraction counterparts. The complete analysis of variance table for this variable is presented in Appendix E.12.

Analysis of the data concerning subjects' self reported frequency of attention to bodily reactions revealed no significant types effect, $F(1,42) = 1.43$, $p = .239$, but a significant conditions effect, $F(2,42) = 4.30$, $p = .020$. A posteriori comparisons between all pairs of condition means were carried out with Newman-Keuls procedures. For all comparisons between pairs of condition means, the differences between the means was required to exceed 0.94 in order to reach the .05 level of significance. These comparisons revealed that the conditions effect was due to the fact that High Distraction Condition subjects reported thinking less about bodily reactions than did subjects in other conditions. No significant difference between Moderate and Low Distraction Condition subjects was found.

The observed condition effect is consistent with the intent of experimental manipulations to lead High Distraction Condition subjects to monitor their bodily reactions less frequently than other subjects. It is interesting to note that although the types by conditions interaction failed to reach significance (see Appendix E.13), the means presented in Table 7.4 indicate that Type A subjects in the High Distraction Condition reported attending less frequently to bodily reactions than any other subject group. This pattern of results is generally consistent with the expectation that Type A subjects in the High Distraction Condition would attend less frequently to bodily reactions than other subjects and is also consistent with the significant types by conditions interaction described earlier for the symptom report data. The complete analysis of variance table for self reported frequency of attention to bodily reactions is presented in Appendix E.13.

7.1.4.3.3 Ratings of cognitive task difficulty and interest

Ratings of cognitive task difficulty and interest were subjected to 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction) analyses of variance. The mean ratings of cognitive task difficulty and interest are presented in Table 7.5.

The analysis of subjects' task difficulty ratings revealed no significant types effect, $F(1,42) = 1.57$, $p = .217$, nor a significant types by conditions interaction, $F(2,42) = 2.19$, $p = .124$. There was, however, a significant conditions effect, $F(2,42) = 19.91$, $p < .001$. A posteriori comparisons between all pairs of condition means was carried out with Newman-Keuls procedures. For all comparisons between pairs of condition means, the differences between the means was required to exceed 0.92 in order to reach the .05 level of significance. These comparisons revealed that the observed conditions effect was due to Low Distraction Condition subjects reporting the light task to be less difficult than subjects in the High and Moderate Distraction Conditions rated the matrices task. No significant difference was found between High and Moderate Distraction Condition subjects.

The above results indicate that manipulations of task complexity had the predicted effect in that the light detection task was perceived as less demanding than the matrices task. Furthermore, although the types by condition interaction did not reach significance, the means presented in Table 7.5 indicate that Type A subjects in the High and Moderate Distraction Conditions tended to rate task difficulty higher than did their Type B counterparts.

Analysis of task interest ratings revealed no significant main effects or interactions. Contrary to the authors' expectations, subjects rated the light detection and matrices tasks as equally interesting. This finding suggests that as far as interest or novelty is concerned, subjects performing the light detection task were as compelled to attend to external stimuli as subjects performing the matrices task. This observation is important because the novelty or interest inherent in the external environment is said to be inversely related to the level of attention allocated to internal stimuli (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980). Therefore, the observation that High and Moderate Distraction subjects may have been as compelled to attend to external stimuli as their Low Distraction Condition counterparts may explain why the analyses of data concerning ratings of work load and ratings of attention to work load and physical reactions did not yield stronger condition effects or types by conditions interactions.

The complete analysis of variance tables for ratings of cognitive task difficulty and interest are presented in Appendices E.14 and E.15.

Table 7.5

Subjects' ratings of the cognitive (matrices or light detection) tasks in terms of difficulty and interest

Conditions	Behaviour Type Groups: Type A	Type B	Condition Means
High Distraction			
Ratings of Task Difficulty	4.12	3.12	3.62
	(1.25)	(1.81)	(1.59)
Ratings of Task Interest	3.87	4.50	4.19
	(2.03)	(0.92)	(1.56)
Moderate Distraction			
Ratings of Task Difficulty	4.37	3.37	3.87
	(1.40)	(1.19)	(1.36)
Ratings of Task Interest	4.00	4.62	4.31
	(1.51)	(1.60)	(1.54)
Low Distraction			
Ratings of Task Difficulty	1.00	1.62	1.31
	(0.00)	(1.19)	(0.87)
Ratings of Task Interest	3.00	3.50	3.25
	(1.77)	(1.93)	(1.81)
Type Group Means			
Ratings of Task Difficulty	3.17	2.71	
	(1.88)	(1.57)	
Ratings of Task Interest	3.62	4.21	
	(1.76)	(1.56)	

Note: All ratings were made on 7-point scales, on which 1 = not difficult or not interesting and 7 = difficult or interesting. Standard deviations are presented in brackets. For each behaviour type group N = 24. For each behaviour type-condition cell n = 8.

7.1.4.3.4 Cognitive task performance

As noted earlier, subjects in the High and Moderate Distraction Conditions performed Raven's (1962) Advanced Progressive Matrices Set 2 during the 6-minute combined exercise-cognitive task period. The number of matrices attempted and the number of matrices correctly solved were subjected to 2 (Types: A/B) x 2 (Conditions: High Distraction/Moderate Distraction) analyses of variance. These analyses failed to reveal any significant main effects or interactions.

Table 7.6
Performance in the matrices task by Type A and Type B subjects in the High and Moderate Distraction Conditions

	Behaviour Type Groups		
Conditions	Type A	Type B	Condition Means
High Distraction			
Matrices Attempted	19.13	17.38	18.25
	(2.10)	(4.66)	(3.61)
Matrices Correctly Solved	15.50	14.25	14.88
	(3.70)	(3.62)	(3.59)
Moderate Distraction			
Matrices Attempted	17.88	14.38	16.13
	(6.08)	(3.96)	(5.28)
Matrices Correctly Solved	13.38	12.00	12.69
	(3.93)	(3.46)	(3.65)
Type Group Means			
Matrices Attempted	18.50	15.88	
	(4.44)	(4.45)	
Matrices Correctly Solved	14.44	13.13	
	(3.85)	(3.61)	

Note: All ratings were made on 7-point scales, on which 1 = not difficult or not interesting and 7 = difficult or interesting. Standard deviations are presented in brackets. For each behaviour type group N = 24. For each behaviour type-condition cell n = 8.

The observation that Type A subjects in the High Distraction Condition reported significantly fewer and less intense symptoms, but did not outperform others can be said to be consistent with the findings of Study 4. That is, the observation above may be argued to suggest that although Type A subjects' allocation of attention to an important, challenging, and demanding task may have caused them to exhibit restricted processing of physical sensations, it did not help them to improve task performance.

The mean number of matrices attempted and the mean number of matrices correctly solved are presented in Table 7.6. The complete analysis of variance tables for these two measures of task performance are presented in Appendices E.16 and E.17.

Subjects in the Low Distraction Condition performed a light detection task during the 6-minute combined exercise-cognitive task period. Their performance in this task was evaluated in terms of the number of lights detected and the speed with which subjects responded to the presentation of lights. It should be noted that all subjects detected all lights presented and that Type A subjects did so with a mean reaction time of 0.448 seconds (SD = 0.085), compared to 0.468 seconds (SD = 0.115) for Type Bs. The difference between these mean reaction times was not significant, $t(14) = 0.39$, $p = .700$.

7.1.5 Discussion

The symptom report data collected in Study 5 support the hypothesis that Type A individuals exposed to complex external stimuli relevant in mastering an ego challenge or threat, under-report exercise-induced symptoms. No significant between-types differences in symptom report were observed when the external environment did not include a combination of important and complex stimuli.

These findings are consistent with the notion that in response to complex and ego challenging or threatening external stimuli, Type A individuals may focus attention on those aspects of the external environment which are considered relevant in mastering the source of challenge or threat, and thus are left with relatively little spare capacity to process physical sensations. This situationally elicited restricted processing of physical sensations and the ensuing elevation in viscerosomatic threshold are consistent with Pennebaker's model of symptom perception (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980) in that these phenomena were mediated by the importance and complexity of external stimuli available for processing.

Furthermore, the above findings are in keeping with the conceptualization of the TABP as one that is elicited from susceptible individuals by appropriately challenging or threatening circumstances (see Burke and Weir, 1980; Friedman and Rosenman, 1971, 1974; Jenkins, 1976, Glass, 1977; Matthews, 1982). It would appear that the restricted processing of physical sensations may be the consequence of a Type A response, namely attention focus on task relevant aspects of the environment, when the external environment is challenging or threatening. This response has to be added to the repertoire of behavioural and physiological responses that Type A individuals have been observed to exhibit in similar circumstances (see Chapter 1 - Section 1.3 and 1.5 and Chapter 2 -Section 2.2.3).

The finding of situationally elicited restricted processing of physical sensations is also consistent with the results of Study 4. As will be recalled, these results indicated that Type A subjects required to perform a complex and ego challenging (important) cognitive task detected less artificially induced physical sensations than Type A subjects exposed to conditions not combining these characteristics and Type B subjects in general.

The observation that in the absence of challenging instructions, manipulations of task difficulty had no effect on the symptom report pattern of Type A individuals is also in keeping with the results of Study 4 and the view that Type A individuals may choose to ignore non salient threats or challenges (see Glass, 1977).

It should be noted that contrary to the support received by a situation specific attention focus explanation of Type A subjects' symptom under-report from analyses of the symptom report data, analyses of the auxiliary data proved inconclusive in this regard. For example, Type A subjects, regardless of condition, rated their work load as being lighter than did Type Bs. This observation is inconsistent with the hypothesis that Type A subjects would only exhibit restricted processing of internal stimuli in the High Distraction Condition and the fact that it was only in that condition that Type A subjects under-reported symptoms. There was, however, a non significant tendency for Type A High Distraction Condition subjects to report a lighter load than other subject groups.

Measures of self-reported frequency of attention allocation to work load and physical reactions were also inconclusive, showing only a non significant tendency for Type A High Distraction Condition subjects to report attending less to work load and physical than other subject groups.

In summary, despite the inconsistencies concerning auxiliary data in Study 5, it can be argued that the pattern of detection of physical sensations and the symptom report exhibited by Type A subjects in Studies 4 and 5 respectively, are consistent with the hypothesis that Type A subjects' symptom under-report may be the manifestation of a situationally elicited, attention focus mediated phenomenon. Furthermore, both sets of findings are consistent with the view that this phenomenon is elicited when the external environment is interpreted by Type As as posing a complex ego challenge or threat.

It is important to note that the evidence referred to above (for Type A individuals' situation specific restricted processing of task-peripheral physical sensations) emerged from studies in which the potential intensity of physical sensations were under experimental control and thus were, in theory, subjectively similar across subjects. This provides a sound base for the assertion that during exposure to complex and ego challenging or threatening external stimuli, Type A subjects in Studies 4 and 5 exhibited an elevated threshold for noticing physical sensations .

The possible implications of Type A individuals' symptom under-report and hypothesized elevation in viscerosomatic threshold during exposure to ego challenging (important) and complex external stimuli, have not been investigated. Given the crucial role played by awareness of physiological arousal and other physical states in the self-regulation of symptom-inducing activities and the onset of moderating and remedial actions (e.g., Carver and Scheier, 1982; Leventhal, Nerenz, and Strauss, 1980; Schwartz, 1983), Type A subjects' restricted processing of physical sensations may lead them to over-exert themselves. Specifically, it could be hypothesized that due to their failure to process symptoms of distress, Type A individuals may delay terminating or moderating detrimental activities or may fail to take other remedial steps. Furthermore, they may require relatively greater levels of objective exertion, physiological arousal, or pathology before acting upon physical sensations. In other words, an elevated viscerosomatic threshold may lead Type A individuals to work their body closer to its limits than do Type Bs.

Chapter 8 reports on a study designed to evaluate the possibility that Type A subjects may fail to regulate physical exertion as 'efficiently' as Type Bs under conditions where external stimuli are complex and perceived as important. This study also served to investigate between-types differences in the processing of symptom information, without having to employ measures of symptom report. This was considered important in order to address the possibility that symptom report may be affected by the different way in which subjects use self-report scales.

CHAPTER 8

8.1 Introduction: Study 6

As noted in Chapter 7, the findings of Studies 4 and 5 appear to provide support for the hypothesis that while exposed to demanding and ego challenging (important) external stimuli, Type A individuals may exhibit restricted processing of task-peripheral physical sensations and, as a consequence, an elevated threshold for noticing these sensations.

Restricted processing of visceral sensations and its accompanying elevation in viscerosomatic threshold may not only have implications for the report of symptoms, but may also determine the extent to which Type A individuals over-exert themselves compared to Type Bs. Type A individuals' failure to process physical sensations (during demanding and challenging circumstances) may lead them to fail to regulate exertion as 'efficiently' as Type Bs. This notion may be better understood with reference to research in the area of visceroperception based self-regulation.

8.1.1 The role of attention to visceral sensations in self-regulatory and remedial actions

Control System Theory (see Carver and Scheier, 1981; Miller, Galanter, and Pribram, 1960; Powers, 1973; Suls and Fletcher, 1985; von Bertalanffy, 1968) is concerned with how parts in a system regulate each other to achieve order and stability. An important concept in Control System Theory is the 'negative feedback loop'. According to the advocators of this theory, the 'negative feedback loop' functions to stabilize or regulate the behaviour or output of a system. Suls and Fletcher (1985), for example, argue that stabilization of output of the system is achieved by comparing the present output with a standard of reference. According to these authors, if a discrepancy between present output and the reference is detected, behaviour may then be emitted to reduce this discrepancy.

Recently there have been efforts to apply the principles of Control System Theory to behavioural medicine. A number of researchers (e.g., Carver and Scheier, 1982; Leventhal, Nerenz, and Strauss, 1982; Schwartz, 1983) have suggested that the way in which individuals act based on symptoms, can be viewed as part of a complex system of negative feedback loops. According to this view, individuals take remedial action when they perceive discrepancy between experienced symptoms and a standard of comparison, such as good health (see Leventhal et al., 1982). Furthermore, according to Control System Theory the experience of distress is a negative feedback process that serves as a cue to engage in appropriate health seeking behaviours (Suls and Fletcher, 1985).

Therefore, the processing of visceral sensations may be a crucial element in the elicitation of self-regulatory behaviours, such as discontinuation or moderation of pathology-inducing activities. Failure to attend to bodily stimuli can result in what Schwartz (1983) refers to as "disregulation". According to Schwartz, disregulation refers to the disconnection between input and output. Schwartz (1983) explains that in a well functioning system, discrepancies between output and the reference standard should lead to adjustment of the input so as to reduce the discrepancy. However, in a disregulated system output is not attended to, nor matched to standard, so the output 'error' continues or increases (see Schwartz, 1983). An example of a disregulated system would be the case of an individual who, as the consequence of failing to attend to symptoms of fatigue, fails to take steps to halt or moderate the activity that is giving rise to the exertion of the organism. The disregulation of the system in this case may lead to the maintenance or increase of the activity and to the over-exertion of the organism.

Pennebaker (1982) has also contributed to the discussion of visceroperception based self-regulation, suggesting that in a complex and demanding external environment, restricted processing of internal stimuli should lead individuals to a more "benign" interpretation of physical sensations. This benign interpretation of physical sensations may in turn influence the extent to which individuals regulate behaviour or take other remedial steps.

8.1.2 Objectives of Study 6

Given that awareness of changes within the body may play a crucial role in the elicitation of self-regulatory behaviours (e.g., Carver and Scheier, 1982; Leventhal, Nerenz, and Strauss, 1982; Pennebaker, 1982; Schwartz, 1983), it would be reasonable to argue that Type A subjects' situationally elicited restricted processing of physical sensations may lead to what Schwartz (1983) has labelled a disregulated system.

Type A individuals' restricted processing of physical sensations during exposure to complex and important external stimuli and its accompanying elevation in viscerosomatic threshold may mean that they remain unaware of their objective level of exertion, physiological arousal or pathology. This in turn would mean that Type A individuals may delay the termination or moderation of symptom-inducing activities or the implementation of other remedial or self-regulatory steps until attention capacity is freed to process bodily changes or until these changes become more salient. Therefore, an elevated viscerosomatic threshold may lead Type A individuals to work the organism closer to its limits than do Type Bs in general and Type As not exposed to complex and important external stimuli.

Consistent with the above, a number of studies have found support, if somewhat indirect, for the notion that during challenging and/or demanding circumstances, Type A individuals may fail to interpret symptoms as signs of illness or injury (see Carver et al., 1981; Hart, 1983; Matthews et al., 1983). Furthermore, it has been observed that when ill, Type A individuals are more likely to attend class (Eagleston et al., 1986; Stout and Bloom, 1982) or work (Matteson and Ivancevich, 1982) and less likely to stay in bed and rest, cancel a date or take medication (Stout and Bloom, 1982) than Type Bs. These observations could be interpreted as indicating a disregulated system (see Schwartz, 1983) whereby the restricted processing of physical sensations and the ensuing elevation in viscerosomatic threshold lead Type A individuals to fail to perceive the full intensity of their symptoms, adopt a more benign interpretation of them, and feel that they do not warrant treatment or the alteration of activities.

The observation that Type A individuals respond to challenges or threats not only with restricted processing of physical sensations, but with behavioural and physiological hyper-responsiveness (see Chapter 1 - Sections 1.3, 1.5 and Chapter 2 - Sections 2.2.2, 2.2.3) suggests that they may over-exert themselves more frequently than Type Bs. This may have important implications for Type A individuals' increased risk for coronary heart disease (CHD).

The present chapter reports on a study designed to evaluate the possibility that under conditions where external stimuli are demanding and perceived as important, Type A subjects may fail to regulate physical exertion as 'efficiently' as Type Bs.

Subjects in Study 6 were asked to maintain, for as long as possible, isometric static contraction to fatigue at a tension of 30% of each individual's maximal voluntary contraction. In order to evaluate the role of external stimulus complexity and its perceived importance in the processing of information about muscle fatigue, all subjects were required to perform two contractions. One of these contractions was carried out under baseline conditions. That is, it was carried out without presentation of any distracting stimuli. The second contraction was performed concurrently with a relatively demanding mental arithmetic task. Furthermore, during this contraction, subjects were allocated to either a challenge condition (in which ego challenge was associated to the performance of the mental arithmetic task) or a no challenge condition. As was the case in previous studies (see Studies 4 and 5), ego challenging instructions were used to manipulate the perceived importance of processing cognitive task-relevant stimuli.

Previous investigations of the effect of distracting cognitive tasks on the endurance of voluntary isometric contractions revealed that subjects performing these contractions while also involved in the performance of mental arithmetic tasks, tend to exhibit an improvement in contraction endurance of 30 to 46% (see Berdina, Kolenko, Kotz, Kuznetzov, et al., 1972; Berdina, Kolenko, Kotz, Kuznetzov, et al., 1971; Berdina, Kolenko, Kotz, Rodionov, Tkhorevsky, 1971; Kotz et al., 1978). Lamb (1984) relates these findings to the observation that activity in higher centres of the brain somehow interferes with the signals delivered by the motor nerves to the contracting muscles, thus permitting subjects to endure contraction for a longer time than when not engaged in performance of a cognitive task.

The above findings can also be said to be consistent with Pennebaker's (1982) model of symptom perception. Pennebaker suggests that the availability for processing of complex, novel, and important external stimuli is inversely related to the processing of physical sensations.

Given the above observations, the investigation of the endurance of muscle contraction to fatigue appears to represent a good avenue for evaluating possible between-types differences in the extent to which self-regulatory behaviours are affected by the complexity and importance inherent in the external environment.

8.1.3 Hypotheses

Based on the observations listed above and the situation specific nature of Type A subjects symptom under-report in Study 5, the following hypotheses were formulated:

(1) It was predicted that Type A subjects exposed to complex and ego challenging external stimuli (Challenge Condition) would exhibit more restricted processing of task-peripheral physical sensations, than Type A subjects exposed to complex external stimuli, but no ego challenging instructions (No Challenge Condition)

and Type B subjects in general. It was hypothesized that this would be manifested in Type A Challenge Condition subjects exhibiting a significantly greater increase (from baseline) in endurance of isometric contraction than that of Type A No Challenge Condition subjects and Type B subjects in general.

(2) No between-types differences in endurance of isometric contractions were expected in the No Challenge Condition, or during the baseline phase of the study (when contraction was performed without exposure to challenging or demanding external stimuli). This hypothesis was based on the observation that, in Studies 4 and 5, Type A subjects only failed to detect physical sensations when exposed to situations in which both complex and ego challenging (important) external stimuli were available for processing.

8.1.4 Method

8.1.4.1 Overview and design

Study 6 was designed to investigate the possibility that Type A subjects may fail to regulate physical exertion as efficiently as Type Bs under conditions in which external stimuli available for processing are complex and perceived as important. In Study 6, Type A and Type B subjects were required to maintain voluntary static handgrip contraction to fatigue (at a tension of 30% of each individual's maximal voluntary contraction capacity) during two trials. During one of these trials subjects were required to perform a relatively complex cognitive task, while during the remaining trial subjects were not exposed to any form of distraction manipulation. Performance of the cognitive task was or was not the subject of ego challenging instructions, depending on the subject's allocation to one of two challenge conditions.

Therefore, the arrangements in Study 6 can be said to be represented by three 2 level factors: behaviour type classification (A/B), conditions of challenge (Challenge/No Challenge), and conditions of distraction (Distraction/No Distraction - repeated measures factor). It should be noted, however, that the Challenge/No Challenge manipulation was nested within the Distraction Condition. That is, the Challenge/No Challenge manipulation was only relevant within the Distraction Condition and not within the No Distraction Condition. The reason for this is that the subject of ego challenging instructions was performance of the distracting cognitive task. In the absence of this task there were no ego challenging instructions presented. As can be appreciated from the Results Section, the above mentioned arrangements do not represent a theoretical or practical problem in terms of data analysis or the evaluation of hypotheses. Endurance of contraction during No Distraction-No challenge cells was treated as a baseline from which to evaluate the relative magnitude of endurance change during ego challenging and/or distracting conditions (i.e., Distraction-Challenge and/or Distraction-No Challenge cells).

8.1.4.2 Subjects' characteristics and their recruitment

Subjects participating in Study 6 were selected from among a group of 68 employees of the Australian Public Service who responded to the third recruitment drive for male volunteers, aged between 20 and 60 years, to participate in psychological research. Recruitment was carried out in a similar manner to that described in relation to earlier studies. As was the case with the first and second recruitment drive, potential subjects were offered estimates of their aerobic capacity and percentage body fat in exchange for participation in a study ostensibly investigating "the effects of fitness on the performance of cognitive tasks".

The classification of subjects' behaviour type was carried out with Form C of the JAS (Jenkins et al., 1979). In order to select for participation relatively extreme scorers on the JAS, this instrument was mailed to all 68 volunteers prior to the commencement of the study. Subjects were classified as Type A or Type B according to whether their JAS Type A scores were above one half of one standard deviation or below one half of one standard deviation, respectively, from the volunteer population mean. As noted earlier (see Chapter 4), this classification procedure was undertaken as a way of ensuring the accurate classification of subjects within their population of origin. Forty-five subjects (22 Type As and 23 Type Bs), who were classified as Type A or Type B by the procedure described above, were selected for participation in Study 6. As can be appreciated from Table 8.1, these 45 subjects had a mean age of 28.59 years (SD = 7.69). The mean age for the selected Type A subjects was 30.25 years (SD = 9.78), while the mean age for the selected Type B subjects was 27.00 years (SD = 4.66). Table 8.1 also presents the mean JAS subscale scores and standard deviations for the selected subject sample.

As can be appreciated from a comparison of Table 8.1 (above) and Table 4.1 (see Chapter 4), the average JAS Type A score and age of individuals who responded to the third recruitment drive was somewhat lower than that exhibited by those who responded to the first recruitment drive. However, these values were consistent with those of individuals who responded to the second recruitment drive (see Table 6.1, Chapter 6). As was the case in the second recruitment drive, a considerable number of individuals (14) who responded to the third recruitment drive were employed in Division Four of the Australian Public Service, while no such persons volunteered in response to the first recruitment drive. The remaining respondents were employed in Divisions Two and Three, with the main body of volunteers coming from Division Three. As noted in relation to the volunteers in the second recruitment drive, it is possible that the inclusion of younger and less occupationally senior employees, may have contributed to lowering the mean JAS Type A score of volunteers in the third recruitment drive. This suggestion is based on the observation that occupational status may be positively associated with Type A behaviour (See Byrne and Reinhart, 1989).

Table 8.1
Means and standard deviations for age and the four subscales of the Form C of the JAS for the total volunteer population and the selected subject sample

	Total Volunteer Population				Selected Sample		
	Mean	SD	Range	N	Mean	SD	N
JAS (Form C) Subscales							
Type A	209.54	64.54	103 - 367	68	213.84	77.56	45
Speed & Impatience	156.04	55.30	33 - 290	68	155.44	59.51	45
Hard-Driving & Comp.	104.34	26.42	50 - 175	68	105.58	30.13	45
Job Involvement	232.49	41.39	143 - 319	68	230.02	40.15	45
Age							
Years	28.96	7.78	22.0 - 59.7	68	28.59	7.69	45

8.1.4.3 Materials and apparatus

Muscle performance or endurance during static contraction was investigated by requiring subjects to maintain handgrip contraction to fatigue on a Bettendorf dynamograph (model 574). This instrument was fitted with a recording device to allow the continuous recording of subjects' contractions. This device permitted the calculation of time expired and level of contraction. The dynamograph also included a pointer to indicate to subjects the level of handgrip which they were required to maintain. The markings on the face of the dynamograph, indicating the level of contraction achieved, were in kilograms.

8.1.4.4 Procedure

8.1.4.4.1 General

Upon making contact with the experimenter, potential subjects were asked the same questions relating to medical history, as subjects in previous laboratory studies reported in this thesis. However, subjects volunteering to participate in Study 6 were also asked about any history of muscle atrophy or dystrophy, repetitive strain injury or any other condition of hands and arms which may have prevented them from participating in the handgrip task. Suitable candidates were then mailed Form C of the JAS, with instructions to complete it and return it as soon as possible. In order to facilitate the return of this questionnaire, potential subjects were provided with addressed and stamped envelopes. Upon receipt of the completed JAS (Form C) questionnaire, subjects were contacted and a suitable appointment was made for them to attend the laboratory. It should be noted that, although volunteers who did not classify as extreme scorers in the Type A subscale of the JAS (Form C) were not selected for participation in Study 6, they were nonetheless invited to attend the laboratory and were given estimates of their maximal aerobic capacity and percentage body fat.

8.1.4.4.2 Determination of maximal isometric voluntary contraction

Each subject was tested individually in a sound deadened and temperature controlled room. Temperature was kept between 20 and 22°C.

On arrival at the laboratory, each subject was asked to sit in front of a table to which the dynamograph was secured. All subjects were informed that prior to the measurement of aerobic capacity, various measures of physical characteristics were to be taken. Specifically, they were informed that aside from weight, height, and body fat, the experimenter was interested in measures of physical strength.

All subjects were then instructed to place the second to fifth fingers of the dominant hand around the pull bar and the palm and the thumb around the support bar of the dynamograph. The distance between the support bar and the pull bar was then adjusted for each subject so that a good grip of the pull bar could be obtained. Following these adjustment procedures, subjects were required to perform three maximal voluntary contraction trials. In each of these trials, subjects were instructed to pull "as hard as possible" and to try to maintain that contraction for 10 seconds. The three maximal voluntary contraction trials were performed at approximately 2-minute intervals. Following Kotz et al.'s (1978) procedure, the level of isometric contraction (as measured in kilograms) at the fifth second of each of the three 10-second maximal voluntary contraction trials, was taken as the maximal voluntary contraction for that trial. This value was read off the recording device fitted to the dynamograph. This device was facing the experimenter and out of the visual field of subjects. The mean value for each of three maximal voluntary contraction trials was taken as the individual's maximal voluntary contraction capacity.

All handgrip tests in Study 6 were performed under conditions of normal blood supply.

8.1.4.4.3 Voluntary static isometric contractions to fatigue

Following the third maximal voluntary contraction trial, the experimenter secured heart rate (HR) electrodes to the subject's chest and asked the subject to remain seated. The experimenter then left the room with the pretext of having to calibrate the polygraph (to be used in the measurement of maximal aerobic capacity), which was located in the adjoining room. In reality, the experimenter proceeded to calculate the value that would tax 30% of each subject's maximal voluntary contraction capacity. Upon his return to the testing room approximately 5 minutes later, the experimenter informed subjects that prior to the estimation of their maximal aerobic capacity, they would be required to perform two further tests on the handgrip apparatus. The experimenter then proceeded to set the pointer, on the face of the dynamograph, to 30% of the subject's maximal voluntary contraction capacity. Furthermore, the experimenter marked the 30% level on the ruler bar of the recording device of the dynamograph. This enabled the experimenter to determine whether the subject maintained the required level of contraction.

All subjects, regardless of behaviour type or condition, were then asked to maintain voluntary handgrip contraction to fatigue at a tension of 30% of their estimated maximal voluntary contraction capacity during two trials 30 minutes apart. Kotz et al. (1978) has noted that a rest period of 30 minutes is sufficient to avoid carry over fatigue effects in handgrip contraction tasks. In the present study, subjects were occupied during the 30-minute inter-trial rest interval by undergoing anthropometric measurements and reading of basic material on the history and description of measures of maximal aerobic capacity.

In both of the 30% contraction trials, all subjects were instructed that at the word "go", they would be required to maintain a handgrip contraction at the level indicated by the pointer, for as long as they could sustain it. They were further informed that if the contraction fell below the level indicated, they would be warned by the experimenter to increase contraction if possible. If contraction was not increased to the required level within a five second period, the experimenter terminated the procedure. Care was also taken that subjects did not exceed the required level. Subjects were not informed that the dynamograph pointer was indicating a certain level of their capacity.

During either the first or the second 30% contraction trial, all subjects were required to perform a relatively demanding cognitive task, while in the remaining 30% contraction trial subjects were not required to perform any tasks. The cognitive task which subjects were asked to perform involved counting backwards by seven from 4,083. This task was introduced as being part of a series of studies investigating the effects of physical work on the performance of mental tasks. In reality, the presence or absence of the mental arithmetic task during isometric contraction constituted a manipulation of distraction from muscle fatigue by varying the extent to which external stimuli were available for processing.

Subjects were instructed to commence counting 10 seconds into the 30% contraction trial. This procedure was implemented so as to permit subjects to achieve the required contraction level before having to perform mental arithmetic. Subjects were corrected every time an error in counting was made. They were also instructed that if they completed the series of numbers, they were to start again from 4,083.

Performance on the mental arithmetic task was or was not the subject of ego challenging instructions depending on the condition to which a subject was allocated. As noted earlier, 45 subjects, 22 Type As and 23 Type Bs, took part in Study 6. Of these, 11 Type As and 12 Type Bs were allocated to the Challenge Condition, while the remaining 11 Type As and 11 Type Bs were allocated to the No Challenge Condition. Prior to the 'distracted' 30% contraction trial, Challenge Condition subjects were informed that the combined performance of the handgrip and the mental arithmetic tasks was required to evaluate the reliability of previous research findings. Ostensibly, these findings had indicated that accurate performance of mental tasks during physically demanding tasks was a "rare" skill which appeared to be observed in "efficient" individuals and that this skill was associated with the ability to meet "multiple demands in every day life". In order to make these instructions more convincing, Challenge Condition subjects were further informed that the accuracy of their performance in the mental arithmetic task was to be correlated with their responses to certain items in the questionnaire which they had earlier completed (i.e., JAS-Form C). They were told that these items measured self-reported activity levels, efficiency in getting things done, and how often they did several things at once or within short periods of time.

These instructions were based on observations by previous researchers that Type A subjects may feel challenged by the opportunity to demonstrate that they are capable of 'rare' skills, as well as perceiving 'efficiency' as a desirable personal characteristic (see Price, 1982; Stern and Elder, 1982).

It is important to note that the subject of the challenge was performance in the mental arithmetic task and not endurance of isometric contraction. Challenge Condition instructions were designed to induce Type A subjects to perceive the processing of mental arithmetic stimuli as an important task. As the name implies, No Challenge Condition subjects were not given ego challenging instructions.

In order to control for the possible carry over effects of fatigue from the first to the second 30% contraction trial, subjects within each of the four behaviour types-condition cells were assigned (as far as numbers permitted) in equal numbers to perform the distracting mental arithmetic task during the first or second 30% contraction trial. However, given the odd number of subjects within each of the two Type A groups and within the Type B-No Challenge Condition cell, perfect counterbalancing could not be achieved within these subject groups. In these cells, the eleventh subject was assigned to perform the mental arithmetic task during the second 30% contraction trial. Therefore, within each of the two Type A groups and within the Type B-No Challenge Condition cell, 5 subjects performed the mental arithmetic task during the first 30% contraction trial and 6 during the second 30% contraction trial.

Upon completion of the second 30% contraction trial, subjects underwent submaximal testing of aerobic capacity and were later debriefed.

8.1.4.4.4 Summary of experimental arrangements

In summary, Study 6 consisted of two phases. During the baseline phase subjects were required to maintain voluntary static isometric contraction to fatigue (at a tension of 30% of maximal voluntary capacity) while not exposed to any distracting or challenging external stimuli. During the study phase, subjects were required to maintain a similar isometric contraction while exposed to a relatively demanding cognitive task. During this phase, cognitive task performance was or was not the subject of ego challenge. Approximately half of the subjects within each group were required to perform the baseline phase first and the study phase second, while the opposite was the case for the remaining subjects.

8.1.5 Results

8.1.5.1 Maximal voluntary isometric contraction capacity

Table 8.2
Mean maximal voluntary isometric contraction (in kilograms) for Type A and Type B subjects in the Challenge and No Challenge Conditions

	Behaviour Type Groups	
Challenge Conditions	Type A	Type B
Challenge	57.545 (5.84)	48.000 (5.22)
No Challenge	56.909 (5.63)	52.727 (10.93)
Type Means	57.227 (5.61)	50.261 (8.59)

Note: The values presented in this table are the mean of three maximal voluntary handgrip contractions. Standard deviations are presented in brackets. For the Type A group N = 22. For the Type B group N = 23. Within each of the Type A-Challenge/No Challenge Conditions cells n = 11. Within the Type B-Challenge Condition cell n = 12. Within the Type B-No Challenge Condition cell n = 11.

In order to ascertain whether subjects within the four behaviour type-condition groups had significantly different maximal voluntary isometric contraction capacities, the mean value of the three maximal voluntary contraction trials was calculated for each subject and subjected to a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) analysis of variance.

This analysis revealed a significant types effect, $F(1,41) = 10.26$, $p = .003$. As can be appreciated from the bottom row of Table 8.2, this finding was due to the fact that Type A subjects exhibited significantly greater voluntary isometric contraction capacity than Type Bs. No other significant terms or interactions were found. The complete analysis of variance table for this variable is presented in Appendix F.1.

8.1.5.2 Endurance of voluntary static isometric contraction to fatigue during the baseline and study phases

As noted earlier, all subjects were required to perform two voluntary static isometric contractions to fatigue at a tension of 30% of their maximal voluntary contraction capacity. The purpose of this was to ensure comparable potential subjective experiences of fatigue across subjects.

One of the two 30% contraction trials was performed in the baseline phase of the study, during which no distracting tasks or ego challenges were presented. Analysis of the duration of voluntary isometric static contractions during the baseline phase of the study consisted of a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) analysis of variance. This analysis revealed no significant types effect, $F(1,41) = 0.01$, $p = .924$, challenge conditions effect, $F(1,41) = 1.89$, $p = .176$, or types by challenge conditions interaction, $F(1,41) = 0.17$, $p = .677$. This indicates that Type A and Type B subjects did not differ in their endurance of muscle contraction in the absence of important and/or demanding external stimuli.

The lack of a significant challenge conditions effect or types by challenge conditions interaction in the baseline phase of the study is not of major theoretical or practical importance, because as will be recalled, manipulations of ego challenge were only introduced during the study phase (i.e., during the presentation of the distracting arithmetic task). The mean duration of voluntary static isometric contractions to fatigue for Type A and Type B subjects during the baseline phase (allocated to the Challenge and No Challenge Conditions during the study phase) is presented in Table

8.3. The analysis of variance table for endurance during the study phase is presented in Appendix F.2.

Table 8.3

Duration (in seconds) of voluntary static isometric contraction to fatigue at a tension of 30% of maximal voluntary contraction during the baseline phase for Type A and Type B subjects in the Challenge or No Challenge Conditions

	Behaviour Type Groups		
Challenge Conditions	Type A	Type B	Condition Means
Challenge	179.27 (61.16)	185.86 (68.48)	182.56 (63.68)
No Challenge	215.54 (81.37)	205.00 (55.66)	210.27 (68.24)
Type Means	197.41 (72.65)	194.87 (62.06)	

Note: Standard deviations are presented in brackets. For the Type A group N = 22. For the Type B group N = 23. For each of the Type A-Challenge/No Challenge Conditions cells n = 11. For the Type B-Challenge Condition cell n = 12. For the Type B-No Challenge Condition cell n = 11.

In order to evaluate the extent to which Type A and Type B subjects' endurance of voluntary static isometric contraction was affected by the introduction of a demanding mental arithmetic task and ego challenge, endurance data collected during the study phase were subjected to a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) analysis of covariance with endurance during the baseline phase as the covariate. This analysis controlled for differences in the baseline phase which may have affected the interpretation of differences during the study phase.

The mean duration of isometric contractions during the study phase and the mean duration of these contractions adjusted for duration of baseline contraction are presented for all groups in Table 8.4. The baseline adjusted study phase means were calculated using statistical options available through the multiple analysis of variance (MANOVA) procedure in the Statistical Package for the Social Sciences ($SPSS^X$ - SPSS Inc., 1983).

Table 8.4

Mean duration (in seconds) of voluntary static isometric contraction to fatigue at a tension of 30% of maximal voluntary contraction during performance of a mental arithmetic task in the study phase for Type A and Type B Challenge and No Challenge Condition subjects. Mean duration of contractions during the study phase adjusted for duration of baseline contractions is also presented in this table.

	Duration of Contraction During the Study Phase			Duration of Contraction During the Study Phase Adjusted for Baseline		
Challenge Conditions	Type A	Type B	Condition Means	Type A	Type B	Condition Means
Challenge	372.91 (144.05)	245.83 (76.40)	306.61 (128.70)	381.18	251.05	316.11
No Challenge	241.09 (102.74)	223.91 (77.82)	232.50 (89.37)	231.79	219.72	225.76
Type Means	307.00 (139.50)	235.35 (76.14)		306.49	235.38	

Note: Standard deviations are presented in brackets. For the Type A group N = 22. For the Type B group N = 23. For each of the Type A-Challenge/No Challenge Conditions cells n = 11. For the Type B-Challenge Condition cell n = 12. For the Type B-No Challenge Condition cell n = 11. The baseline adjusted study phase means were derived from a statistical option available through the MANOVA procedure in $SPSS^X$ (SPSS Inc., 1983).

The analysis of covariance described above revealed a significant types effect, $F(1,40) = 5.98$, $p = .019$. As can be appreciated from Table 8.4, this finding was due to the fact that while distracted (in the study phase) Type A subjects (regardless of challenge condition) exhibited a greater increase (from baseline) in endurance of isometric contraction than did Type Bs. It was also found that while distracted (in the study phase), Challenge Condition subjects (regardless of behaviour type) exhibited a significantly greater increase (from baseline) in endurance of isometric contraction than did their No Challenge Condition counterparts, $F(1,40) = 8.50$, $p = .006$.

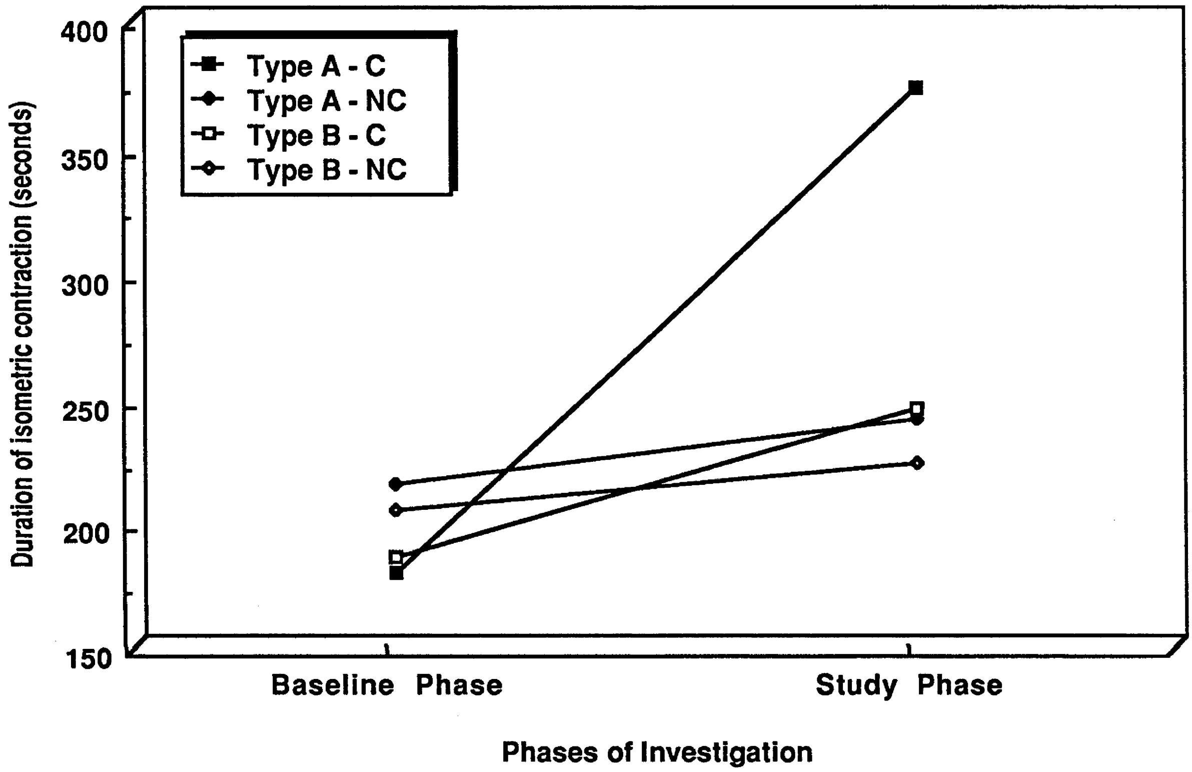

Figure 8.1
Graphical representation of duration (in seconds) of isometric static contraction to fatigue (at a tension of 30% of maximal voluntary contraction) during the baseline phase (where no distraction or challenge was presented) and the study phase (where subjects were required to perform a cognitively demanding task and were allocated to either the Challenge (C) or No Challenge (NC) Conditions)

The analysis of covariance of the contraction duration data also revealed a nearly significant types by conditions interaction, $F(1,40) = 3.96$, $p = .054$. This interaction is presented graphically in Figure 8.1. In order to elucidate the nature of this interaction, a posteriori comparisons between all pairs of types-conditions cells (baseline adjusted) study phase means were carried out. Given the different number of subjects in the Type B-Challenge Condition cell compared to the three other types-conditions cells, it was necessary to carry out pairwise comparisons between cell means with an a posteriori procedure that would take into account minor differences in subject numbers. Kirk (1982) recommends Spjøtvoll and Stoline's (1973) procedure for a posteriori pairwise comparisons when n's are approximately equal. This procedure is a generalization of the Tukey's (1953) test and is referred to as the *T'* test. For a more detailed discussion of Spjøtvoll and Stoline's test the reader is referred to Kirk (1982).

Spjøtvoll and Stoline's *T'* test revealed that, while exposed to important and demanding external stimuli (in the study phase), Type A Challenge Condition subjects exhibited a significantly greater increase (from baseline) in endurance of isometric contraction than their No Challenge Condition counterparts and Type B subjects in general. No significant differences between other types-conditions cell means were found. In all cases, the critical difference that a pairwise comparison with Spjøtvoll and Stoline's *T'* test had to exceed to be declared significant at the .05 level was 114.94.

It should be noted that the above findings reflect the fact that during the study phase, Type A Challenge Condition subjects exhibited an increase (from baseline) in the duration of their isometric contraction of 108.01% compared to 32.37% for Type A No Challenge Condition subjects and 11.85 and 9.22%, respectively, for Type B Challenge and No Challenge Condition subjects.

The complete analysis of covariance table for the endurance variable is presented in Appendix F.3.

8.1.5.3 <u>Performance on the mental arithmetic task</u>

Performance on the mental arithmetic task was quantified in terms of the number of items attempted, the number of correct responses, and the rate of response (i.e., time elapsed divided by the number of items attempted). Table 8.5 presents the mean and standard deviations for behaviour type groups and types-conditions cells on the performance measures mentioned above.

The three performance variables were subjected to 2 (Types: A/B) x 2(Conditions: Challenge/No Challenge) analyses of variance. These analyses failed to reveal any significant effects or interactions. The complete analysis of variance tables for these three variables are presented in Appendices F.4 to F.6.

Table 8.5

Mean number of items attempted, correct responses, and mean rate of response in the mental arithmetic task for Type A and Type B Challenge and No Challenge Condition subjects

Challenge Conditions	Behaviour Type Groups: Type A	Type B	Condition Means
Challenge			
Items Attempted	98.64	66.92	82.09
	(72.25)	(22.28)	(53.70)
Correct Responses	95.36	63.41	78.70
	(72.64)	(22.97)	(54.32)
Response Rate	3.95	3.79	3.87
	(1.54)	(0.74)	(1.17)
No Challenge			
Items Attempted	74.09	75.27	74.68
	(46.57)	(34.27)	(39.90)
Correct Responses	71.27	72.45	71.86
	(47.34)	(34.59)	(40.46)
Response Rate	4.28	4.14	4.21
	(3.03)	(1.48)	(2.33)
Type Means			
Items Attempted	86.36	70.91	
	(60.63)	(28.29)	
Correct Responses	83.32	67.74	
	(61.09)	(28.79)	
Response Rate	4.11	3.96	
	(2.35)	(1.14)	

Note: Standard deviations are presented in brackets. For the Type A group N = 22. For the Type B group N = 23. For each of the Type A-Challenge/No Challenge Conditions cells n = 11. For the Type B-Challenge Condition cell n = 12. For the Type B-No Challenge Condition cell n = 11.

8.1.6 Discussion

The results of Study 6 generally served to confirm previous findings regarding the facilitating effect of mental arithmetic on endurance of voluntary static isometric contraction (e.g., Berdina, Kolenko, Kotz, Kuznetzov, et al., 1972; Berdina, Kolenko, Kotz, Kuznetzov, et al., 1971; Berdina, Kolenko, Kotz, Rodionov, Tkhorevsky, 1971; Kotz et al., 1978). Furthermore, having to perform the arithmetic task under ego challenging instructions (in the Challenge Condition) led subjects (regardless of behaviour type) to exhibit a significantly greater increase (from baseline) in endurance of isometric contraction than when the arithmetic task was presented without ego challenging instructions (in the No Challenge Condition).

More importantly, the results of Study 6 yielded support for the hypothesis that while exposed to ego challenging (important) and demanding external stimuli, Type A subjects would exhibit a significantly greater increase (from baseline) in endurance of isometric contraction than Type A subjects not exposed to these stimuli and Type B subjects in general. Although analysis of covariance of the endurance data revealed a types effect, a posteriori analysis of the significant types by conditions interaction revealed that it was only when performance in the mental arithmetic task was associated with ego challenge (in the Challenge Condition), that Type A subjects exhibited extreme increases (from baseline) in the endurance of isometric contraction. These increases averaged 108.01% which represents a significantly greater increase than the 32.37% exhibited by Type A No Challenge Condition subjects and the 11.85 and 9.22% exhibited by Type B Challenge and No Challenge Condition subjects, respectively. Furthermore, the average increase of 108.01% exhibited by Type A Challenge Condition subjects was well above the maximal cognitive task-facilitated increases of 30 to 46% observed in the general population in previous studies (see Berdina, Kolenko, Kotz, Kuznetzov, et al., 1972; Berdina, Kolenko, Kotz, Kuznetzov, et al., 1971; Berdina, Kolenko, Kotz, Rodionov, Tkhorevsky, 1971; Kotz et al., 1978).

The a posteriori comparison of between types-conditions cell means described above, revealed no significant differences in increased endurance of isometric contraction between Type A No Challenge Condition subjects and either of the Type B groups. Furthermore, no significant between-types differences were observed in the endurance of isometric contraction during the baseline phase of the study. These observations support the hypothesis that between-types differences in the endurance of isometric contraction would not be elicited by conditions which did not include complex and important external stimuli.

These findings tend to once again confirm the situationally elicited nature of between-types differences in the processing of visceral stimuli and the role of external environmental complexity and importance in this phenomenon (see Studies 4 and 5).

Moreover, the results of Study 6 indicate that the situationally elicited restricted processing of physical sensations may have implications for the self-regulatory behaviour of Type A individuals. It would appear that Type A Challenge Condition subjects may have endured (study phase) isometric contraction for a longer period of time than other groups, because they were prompted by situational characteristics to concentrate processing capacity on important and cognitively demanding external stimuli at the expense of task-peripheral physical sensations. It can be argued that this represents an example of disregulation (see Schwartz, 1983), whereby the failure of Type A Challenge Condition subjects to attend to bodily changes resulted in exertion-inducing activity continuing well past the level normally tolerated by these subjects. This delay in implementing self-regulatory behaviours is consistent with the notion that during exposure to complex and challenging external stimuli, Type A individuals may experience an elevation of viscerosomatic threshold and thus may require objectively more intense bodily changes before becoming aware of symptoms and acting upon them.

It should be noted that between-types differences in endurance of isometric contraction cannot be attributed to Type A subjects' greater motivation to do well in the isometric contraction task. If this had been the case, Type A subjects would have outlasted Type Bs during the baseline phase of the study (when no important or demanding external stimuli were available for processing).

Finally, Study 6 served to investigate between-types differences in the processing of symptom information, without relying on measures of symptom report. This was considered important, because it is possible that symptom report in previous studies may have been distorted by between subjects differences in the use of rating scales and difficulties inherent in the retrospective rating of symptoms experienced during a task period. The measurement of self-regulatory actions appears to be a more direct measure of subjects' processing of visceral stimuli than are self-reports (see Pennebaker, 1982). Self-regulatory actions, such as stopping and resting when fatigued, are more automatic (i.e., they may not involved high order cognitive processing) and rely more directly on the processing of bodily information than does symptom report (see Pennebaker, 1982). Therefore, it could be argued that Study 6 provided more direct evidence than did previous studies in support of situationally elicited, attention focus mediated, between-type differences in the processing of visceral sensations.

The observation that Type A individuals' restricted processing of physical sensations (during exposure to ego challenging and demanding external stimuli) may lead these individuals to less efficiently implement self-regulatory behaviours, may be important in explaining the increased risk for CHD associated with Type A classification. This point is discussed in greater detail in Chapter 9.

CHAPTER 9

9.1 Summary of findings

The studies reported in this thesis aimed to systematically investigate the processes underlying Type A individuals' symptom under-report. This investigation attempted to replicate this phenomenon in groups of employed adult males and involved the consideration of alternative hypotheses.

In the first three studies reported, it was considered whether Type A individuals' symptom under-report manifested a dispositional generalized tendency or a situationally elicited response.

In view of the lack of support for hypotheses emphasizing dispositional variables and the situationally elicited "suppression" of symptoms, the final three studies reported in this thesis investigated the hypothesis that Type A individuals' symptom under-report may be underlain by situationally elicited, restricted processing of physical sensations. Furthermore, these studies sought to identify the situational characteristics capable of eliciting restricted processing of physical sensations from Type A individuals.

The final study reported here also sought to evaluate the implications that situationally elicited, restricted processing of visceral sensations may have for Type A individuals' self-regulatory and remedial behaviours.

A summary of the findings and the conclusions arising from the six studies reported in this thesis is presented in the following sections.

9.1.1 Study 1

In Study 1 (see Chapter 4) an attempt was made to replicate published findings of symptom under-report by Type A individuals. Additionally, Study 1 was designed to investigate the relative merits of hypotheses which had been proposed to explain this phenomenon.

One of these hypotheses conceptualizes Type A individuals' symptom under-report as a strategy which involves the "suppression" or denial of symptoms in order to safeguard personal control over ongoing challenging circumstances (see Carver et al., 1976; Weidner and Matthews, 1978). In order to test this hypothesis, Study 1 included two conditions of expected task duration. In one of these conditions, subjects were asked to report symptoms when they still expected to continue performing a challenging cognitive task. Subjects in the remaining condition were asked to report symptoms at the completion of such a task. Based on Carver et al.'s (1976) and Weidner and Matthews' (1978) reasoning, it was hypothesized that if symptom under-report by Type A individuals was motivated by the desire to protect ongoing performance, Type As should only under-report symptoms when expecting to continue working on a challenging task.

The second hypothesis evaluated in Study 1 views Type A individuals' symptom under-report as the product of maximal allocation of attention to challenging task-relevant aspects of the environment, at the expense of task peripheral stimuli such as symptoms (see Matthews and Brunson, 1979; Weidner and Matthews, 1978). Study 1 sought to evaluate the merits of this hypothesis by attempting to ascertain whether Type A subjects' symptom under-report was associated with greater processing of task-relevant stimuli and with restricted incidental processing of other task-peripheral stimuli. This was carried out by comparing not only subjects' symptom report, but also their ability to recall (post-task) task-relevant and task-peripheral external stimuli. At the completion of performance of a challenging cognitive task, subjects were asked to recall task-peripheral words and task-relevant symbols which had been present during task performance.

It was hypothesized that if Type A individuals' symptom under-report was underlain by a disproportionate allocation of attention to challenging task-relevant aspects of the environment at the expense of task-peripheral stimuli, then Type A subjects in Study 1 would report fewer and less intense symptoms and recall fewer task-peripheral words and more task-relevant symbols than Type Bs. Consistent with a limited capacity model of attention (see Easterbrook, 1959; Kahneman, 1973, Navon and Gopher, 1973), it was expected that if Type As allocated a greater proportion of their attention capacity to a task which they considered important, they would be more likely than Type Bs to process stimuli that were immediately relevant to the task, but less likely to process task-peripheral stimuli, such as symptoms and words.

Consistent with previous studies (e.g., Dembroski et al., 1979; Dembroski et al., 1977; Glass, 1977; Golband, 1980; Manuck et al., 1978; Manuck and Garland, 1979), Study One confirmed that Type A subjects respond to performance in ego challenging cognitive tasks with greater cardiovascular arousal than Type Bs. Furthermore, Study 1 also confirmed that physiological hyper-responsiveness in the face of ego challenge is not restricted to Type A university students, but also extends to Type A employed adult males.

More importantly, Study 1 demonstrated that previous findings of symptom under-report by Type A university students (e.g., Dembroski et al., 1978; Hart, 1983; Holmes et al., 1982; Manuck and Garland, 1979; Pittner and Houston, 1980; Weidner and Matthews, 1978)) could be replicated with employed adult males. It was found that the higher physiological arousal exhibited by Type A subjects (compared to Type Bs) was at variance with their report of fewer and less intense physical and emotional symptoms.

No support was found for a "suppression" or denial explanation of Type A subjects' symptom under-report (see Carver et al., 1976; Weidner and Matthews, 1978). Contrary to Weidner and Matthews' (1978) findings, Study 1 revealed that symptom under-report was not restricted to Type A subjects who expected to continue working on a challenging cognitive task. In fact, Study 1 demonstrated that manipulations of expected task duration had no effect on any variables, and that Type A subjects reported fewer physical symptoms and anxiety, regardless of this manipulation.

Study 1 also failed to provide clear support for the hypothesis that Type A individuals' symptom under-report may be underlain by their maximal concentration of processing capacity on challenging task-relevant stimuli at the expense of task-peripheral stimuli. Type A subjects were expected to recall more task-relevant symbols and fewer task-peripheral words than Type Bs if the cause of their symptom under-report was to be attributed to their policy of attention allocation to task-relevant and task-peripheral stimuli. However, the results of Study 1 revealed that Type A subjects' symptom under-report was not accompanied by superior post-task recall of task-relevant symbols or poorer post-task recall of task-peripheral words.

Despite the results mentioned above, certain aspects of the data from Study 1 were consistent with the proposition that Type A individuals may have exhibited restricted processing of task-peripheral stimuli during performance of the challenging cognitive task. Type A subjects exhibited what appeared to be an elevated threshold for noticing elevations in heart rate (HR). These subjects required elevations in HR of a greater magnitude than those required by Type Bs before being able to report some degree of heart racing. Furthermore, when Type A subjects did report some degree of heart racing, they reported a similar intensity of this symptom to that of their less aroused Type B counterparts. Also consistent with the notion that Type A subjects may have had less strong traces for task-peripheral stimuli, these subjects were observed to be less confident about their recognition of task-peripheral words than Type Bs.

9.1.2 Study 2

Study 2 (see Chapter 4) investigated the possibility that Type A individuals' symptom under-report may be a manifestation of a dispositional tendency. It was hypothesized that Type A individuals may be dispositionally less capable of detecting visceral sensations. In order to evaluate this hypothesis, subjects in Study 2 were required to perform a cardiac perception task. They were required to attend to, and count the occurrence of heart beats while exposed to no challenge manipulations or distracting stimuli.

Cardiac perception tasks had been found by previous investigators to yield evidence of individual dispositional differences in the ability to detect visceral sensations (see Brener, 1977, 1978; Hantas et al., 1984; Jones and Hollandsworth, 1982; Katkin et al., 1981; Schandry, 1981). Furthermore, this ability had been found to be positively associated with self-reported intensity of emotional experience and the accurate perception of physiological processes (see Hantas et al., 1982; Katkin et al., 1982; Schandry, 1981).

It was hypothesized that, if Type A individuals' symptom under-report was associated with a dispositional tendency for a poorly developed ability to process visceral stimuli, Type A subjects should perform significantly worse than Type Bs in the cardiac perception task. However, analyses of the data from Study 2 revealed that Type A subjects performed as well as Type Bs in this task. This finding did not support the hypothesis that Type A individuals were dispositionally less competent in detecting visceral stimuli.

Given that in Study 1 Type A subjects appeared unable to accurately process cardiac stimuli as efficiently as Type Bs, the observation that in Study 2 the same Type A subjects were dispositionally as competent as Type Bs in the detection of cardiac stimuli was considered an interesting one. This prompted an attempt to ascertain whether dispositional visceral perceptiveness (as measured by performance in the cardiac perception task in Study 2) could predict the report of heart racing in Study 1.

This analysis confirmed that in Study 1, Type As were seemingly unable to make use of the visceral perceptive skills that they demonstrated in Study 2. It was found that within the Type B group, subjects who reported some degree of heart racing in Study 1 and those who did not differed significantly in their visceral perception ability (as assessed by performance in the cardiac perception task in Study 2). However, this was not the case within the Type A group. Furthermore, in Study 1 dispositional visceral perceptiveness was a reasonable predictor of self-reported total physical symptoms and self-reported elevations in anxiety within the Type B group, but not within the Type A group.

In general, the results of Study 2 revealed that Type A and Type B subjects did not differ in their dispositional ability to process visceral stimuli. This finding was taken to indicate that, when not exposed to distracting and/or challenging external stimuli, Type As may be as capable as Type Bs of processing these stimuli. This suggested that specific aspects of the experimental conditions in Study 1 may have militated against Type A individuals making use of their visceral perception ability and may have contributed to an elevated viscerosomatic threshold.

9.1.3 Study 3

The evidence indicating that Type A subjects were dispositionally as competent as Type Bs in the processing of visceral sensations in Study 2 was obtained under conditions in which subjects were specifically requested to attend to such stimuli. Therefore, no data were available regarding possible between-types differences in the dispositional tendency to self-initiate attention to internal aspects of the body. It was hypothesized that, although Type A subjects may be as capable as Type Bs of processing visceral stimuli, they may be dispositionally prone to attend less habitually to these stimuli than Type Bs.

This hypothesis was evaluated in Study 3 (see Chapter 5) by the calculation of correlation coefficients between measures of Type A behaviour and measures of private self (see Fenigstein et al., 1975) and body consciousness (see Miller et al., 1981).

According to self consciousness theory, there are individual differences in the extent to which individuals are inclined to attend to private and public aspects of the self and body and in how regularly they do so (see Buss, 1980, Carver and Scheier, 1978; Buss and Scheier, 1976; Scheier and Carver, 1977; Scheier et al., 1979). Furthermore, this theory proposes that a person whose attention is habitually directed inward should score higher in measures of private self and body consciousness, and should be more cognizant of private aspects of the self and body than a person whose attention is directed elsewhere (e.g., Fenigstein et al., 1975; Miller et al., 1981). This proposition appeared to be supported by the observation that scores in measures of private self and body consciousness were positively correlated with awareness about bodily processes and states (e.g., Gibbons et al., 1979; Miller et al. 1981; Scheier et al., 1979).

It was reasoned that, as a consequence of socialization experiences, Type A individuals may adopt a less acute body monitoring orientation than Type Bs. It was therefore hypothesized that Type A subjects' symptom under-report may represent these individuals' less habitual allocation of attention to their bodies. This dispositional tendency was expected to be manifested in negative correlation coefficients between JAS subscales scores and scores in measures of dispositional private self and body consciousness.

However, the results of Study 3 failed to support the above mentioned hypothesis. In fact, all correlation coefficients were non significant and the direction of these coefficients was positive. This was interpreted to indicate that Type A behaviour was not significantly associated with dispositional private self and body consciousness.

9.1.4 Study 4

Studies 2 and 3 indicated that differences in the symptom report pattern of Type A and Type B individuals could not be explained in terms of between-types differences in the dispositional ability to perceive visceral sensations nor in the dispositional tendency to habitually attend to these stimuli. In view of these findings, it was thought necessary to reconsider the possibility that Type A individuals' symptom under-report may be part of a situationally elicited response. In particular, it was decided to elaborate upon the tentative evidence provided by Study 1 in support of the hypothesis that Type A subjects' symptom under-report may manifest the restricted processing of task-peripheral stimuli during challenging circumstances.

Study 4 (see Chapter 6) investigated the above by comparing Type A and Type B subjects' ability to process and detect somatosensory stimuli presented under conditions which varied in terms of the complexity of external information available for processing and of the ego challenge (importance) associated with the processing of this information. This study was thought to represent an improvement over previous ones, because it allowed the experimenter to control the intensity and frequency of (electrically induced) physical sensations.

It was predicted that Type A subjects exposed to ego challenging (important) external stimuli would be slower in processing (electrically induced) physical sensations and would fail to detect more of these sensations than Type As not exposed to these external stimuli and Type B subjects in general. It was hypothesized that the above effect would be more marked when the ego challenging (important) external stimuli were relatively complex rather than simple.

The results of Study 4 were consistent with this hypothesis. It was found that regardless of ego challenge or level of task complexity, Type A subjects tended to process (electrically induced) physical sensations more slowly than Type Bs. However, it was only in the condition which required the processing of ego challenging (important) and complex external stimuli that Type A subjects were more likely to fail to detect task-peripheral (electrically induced) physical sensations than Type Bs. Importantly, no between-types differences in the detection of physical sensations were observed during baseline (that is, in the absence of demanding and ego challenging external stimuli) or when external stimuli did not combine the characteristics of difficulty and perceived importance.

These results were taken to indicate that restricted processing of task-peripheral stimuli by Type A individuals may be limited to those conditions where subjects are exposed to relatively difficult external stimuli and in which (because of their association with ego challenge) these stimuli are perceived as important. It was concluded that the combination of these situational characteristics promoted focusing of attention on task-relevant external stimuli at the expense of task-peripheral internal stimuli. Furthermore, the findings of Study 4 were consistent with the notion that, when exposed to important and relatively complex external stimuli, Type A individuals may exhibit an elevation of viscerosomatic threshold. This conclusion was supported by two observations: (a) during the baseline period (when the processing of electrically induced physical sensations was not hindered by the availability for processing of external stimuli), Type A subjects not only detected all presentations of internal stimuli as did Type Bs, but were faster than Type Bs in processing them; (b) when exposed to complex and important external stimuli, Type A subjects tended to be slower than Type Bs in processing electrically induced physical sensations and were less likely than Type Bs to detect these sensations.

9.1.5 Study 5

Study 4 provided evidence that Type A individuals exhibited restricted processing of physical sensations in conditions in which complex and important external stimuli were available for processing.

However, Study 4 did not permit the measurement of the incidental processing of actual symptom information, because subjects were forewarned that they would experience physical sensations while performing a primary task. This experimental arrangement (in which the report of internal sensations was treated as a task), may not have represented a direct evaluation of subjects' ability to incidentally process actual symptoms. Furthermore, the physical sensations which subjects were asked to report in Study 4 were produced by artificial means rather than being actual responses of the organism to environmental conditions. Therefore, caution should be exercised when commenting on Type A individuals' incidental processing of actual symptoms based on the data yielded by Study 4.

Study 5 (see Chapter 7) attempted to evaluate in a more direct manner possible between-types differences in the incidental processing of actual physiological reactions. Subjects in Study 5 were required to exercise on a bicycle ergometer under conditions which varied in the complexity of external stimuli available for processing and the extent to which the processing of these stimuli was important in mastering an ego challenge. At the conclusion of the exercise period, subjects were asked to report the symptoms they had experienced during this period. In order to facilitate the comparison of subjects' symptom report, the experimenter exercised control over subjects' effort expenditure on the bicycle ergometer.

Based on Pennebaker's model of symptom perception (see Pennebaker, 1982; 1983; Pennebaker and Lightner, 1980), it was predicted that all subjects (regardless of behaviour type classification) would report fewer and less intense symptoms when exercising in the presence of important and complex external stimuli (in the High Distraction Condition) than when exercising in the absence of such stimuli (in the Low Distraction Condition) or when complex but unimportant external stimuli were available for processing (in the Moderate Distraction Condition).

More importantly, it was predicted that due to Type A individuals' concern with ego challenge or threat, the above effect would be more marked within the Type A group. That is, Type A subjects exposed to complex and important external stimuli (in the

High Distraction Condition) were expected to exhibit more restricted processing of physical sensations than Type A subjects in other conditions and than Type B subjects in general.

Contrary to expectations, analysis of the symptom report data yielded by Study 5 revealed no distraction conditions effect. However, as predicted, there was a significant types by distraction conditions interaction. A posteriori analysis revealed that this interaction was attributable to the fact that Type A subjects in the High Distraction Condition reported fewer and less intense symptoms than any other subject group.

It is important to note that no between-types differences in the report of symptoms were observed when external stimuli available for processing were relatively simple and monotonous (in the Low Distraction Condition) or when external stimuli were complex but presented without ego challenging instructions (in the Moderate Distraction Condition). This was consistent with the findings of Study 4 and tended to confirm that between-types differences in the processing of visceral stimuli may be situationally elicited and related to the availability for processing of complex and important external stimuli.

9.1.6 Study 6

Having obtained evidence for situationally elicited between-types differences in the processing of physical sensations, it was judged necessary to investigate the possible implications of this finding. It was hypothesized that restricted processing of physical sensations may not only lead Type A individuals to under-report these sensations, but also to work the organism closer to its limits than Type Bs.

This argument was based on Control System Theory (see Carver and Scheier, 1981; Leventhal et al., 1982; Schwartz, 1983; Suls and Fletcher, 1985; von Bertalanffy, 1968), which suggests that the experience of physical distress leads individuals to engage in health seeking or self-regulatory behaviours. Failure to attend to physical sensations may therefore result in a more benign interpretation of these sensations and a delayed implementation of self-regulatory and remedial steps.

This hypothesis was evaluated in Study 6 by measuring the extent to which Type A and Type B subjects would endure exertion and muscle fatigue during conditions which varied in terms of the availability for processing of complex and important external stimuli. Subjects in Study 6 were required to maintain isometric static contraction to fatigue at a tension of 30% of each individual's capacity, during a baseline trial (which involved no distracting external stimuli) and during a study trial (which involved performance of a relatively difficult cognitive task presented with or without ego challenging instructions).

Based on the findings of Studies 4 and 5, it was hypothesized that Type A subjects exposed to relatively complex and ego challenging (important) external stimuli would exhibit a significantly greater increase (from baseline) in endurance of isometric contraction than when not exposed to these stimuli and Type Bs in general. No between-types differences were expected in endurance of isometric contraction during baseline or in the absence of the combination of complex and important external stimuli.

As expected, analyses of the data yielded by Study 6 revealed that Type A and Type B subjects did not differ significantly in the length of time for which they endured isometric contraction in the absence of complex and important external stimuli (i.e., in the baseline trial). Also consistent with expectations, it was found that Type A subjects exposed to complex and important external stimuli exhibited a significantly greater increase (from baseline) in endurance of isometric contraction than did their counterparts who were exposed to complex cognitive stimuli but who received no ego challenging instructions, and Type Bs in general.

These findings confirmed that Type A individuals' restricted processing of physical sensations was not part of a generalized phenomenon, but one limited to circumstances in which these individuals were exposed to ego challenging (important) and relatively complex external stimuli. Furthermore, Study 6 indicated that this situation specific, restricted processing of physical sensations may have important implications for self-regulation. It was concluded that, due to their restricted processing of physical sensations, Type A individuals exhibited an elevated viscerosomatic threshold, which caused them to exert themselves significantly past the level of exertion which they would normally tolerate when not motivated to concentrate attention capacity on what they perceived as challenging or threatening external aspects of the environment.

9.2 General Conclusions

As noted in Chapter 3 (see Section 3.1.1), the majority of studies investigating the symptom report pattern of Type A individuals have involved populations of undergraduate male and female university students (e.g., Carver et al., 1976; Dembroski et al., 1978; Hart, 1983; Holmes et al., 1982; Manuck et al., 1978;

Manuck and Garland, 1979; Pittner and Houston, 1980; Weidner and Matthews, 1978). However, it is employed adult men who have been shown to exhibit the greatest incidence of CHD (e.g., Johnson, 1977) and for whom the association between the TABP and CHD has been demonstrated (e.g., Rosenman et al., 1964). Therefore, to draw conclusions about the contribution of symptom under-report to the risk for CHD associated with Type A classification in employed adult men, it is important to establish that this population does exhibit the symptom under-report phenomenon. Given this consideration, the recruitment of employed adult males for inclusion in the studies reported in this thesis was considered an important practical issue.

The results of the empirical work reported in this thesis indicate that findings of symptom under-report in populations of undergraduate university students (e.g., Carver et al., 1976; Dembroski et al., 1978; Hart, 1983; Holmes et al., 1982; Manuck et al., 1978; Manuck and Garland, 1979; Pittner and Houston, 1980; Weidner and Matthews, 1978) are replicable in samples of employed adult men (see Studies 1 and 5).

The results of the studies reported here indicate that the symptom under-report exhibited by Type A employed adult males can not be explained by dispositional visceral perceptiveness and private self and body consciousness which have been shown previously to predict the accuracy and intensity of self-reported physical and emotional states (see Gibbons et al., 1979; Hantas et al., 1982; Katkin et al., 1982; Schandry, 1981; Scheier, 1976 Scheier and Carver, 1977; Scheier et al., 1979; Miller et al., 1981). No between-types difference was observed in dispositional visceral perceptiveness (see Study 2) and no inverse relationship was found between Type A behaviour and self-reported dispositional tendency to habitually attend to private aspects of the self and body (see Study 3).

The results of the studies reported here suggest that Type A subjects' symptom under-report is restricted to specific eliciting circumstances (see Study 5). This is consistent with findings concerning Type A individuals' situation specific manifestation of behavioural and physiological hyper-responsiveness (see Chapter 1 - Sections 1.3 and 1.5 and Chapter 2 - 2.2.2 and 2.2.3). Furthermore, this observation is congruent with the conceptualization of the TABP as a response set that is elicited from susceptible individuals by appropriately challenging environmental stimuli (see Burke and Weir, 1980; Friedman and Rosenman, 1971, 1974; Jenkins, 1976; Glass, 1977; Matthews, 1982).

The findings of Studies 4, 5, and 6 (and to a lesser extent those of Study 1) suggest that Type A individuals' symptom under-report may be the result of the restricted processing of visceral stimuli in situations where demands on attention capacity by important and complex external stimuli are given priority over other stimuli. This observation is consistent with Pennebaker's model of symptom perception (see Pennebaker, 1982, 1983; Pennebaker and Lightner, 1980) which states that the processing of physical sensations is inversely related to the importance, novelty, interest and complexity inherent in the external environment. According to this view, attention capacity at any given time is limited and only a finite amount of information can be processed at any given moment. Thus, by definition, the allocation of attention to more novel, interesting, complex, and important aspects of the environment means that less than total capacity is available to process other stimuli.

It can be argued that Type A individuals may allocate a greater proportion of attention capacity than do Type Bs to ego challenging and complex aspects of the external environment due to the psychological needs and motivations which underlie the TABP. Although the specific nature of these psychological constructs is not yet clear (see Chapter 1- Section 1.5), Type A individuals may be driven by concerns about failure (see Gastorf and Teevan, 1980), threats to self-esteem (Friedman et al., 1981), threats to personal control (see Glass, 1977) and/or the need for social recognition (see Price, 1982).

It is likely that extreme allocation of attention capacity to aspects of the external environment which are presented as complex and diagnostic of ability may represent a response to what Type A individuals perceive as potential challenges or threats or as opportunities to obtain recompense. Thus the restricted processing of physical sensations exhibited by Type A subjects in Studies 1, 4, 5, and 6 may be the product of extreme attention allocation to aspects of the experimental situation which they interpreted as important because they tapped the psychological needs and/or motivations which underlie the TABP.

The observation that when exposed to important and complex external stimuli, Type A individuals may delay self-regulatory action (see Study 6) is consistent with the view that restricted processing of physical sensations may lead to "disregulation" (see Schwartz, 1983). As will be recalled, Control System Theory (see Carver & Scheier, 1982; Leventhal, Nerenz, and Strauss, 1982; Schwartz, 1983) states that disregulation of the system occurs when failure to attend to cues of distress leads to the continuation of exertion-inducing activities. This observation may have implications for understanding the role played by symptom awareness in mediating the association between the TABP and CHD. These implications are described in greater detail in Section 9.4 of this chapter.

9.3 The contribution of the present work

9.3.1 Methodological and practical contributions

An important contribution to the investigation of Type A subjects' symptom under-report made by the research studies reported in this thesis is the fact that these studies were carried out on samples of employed adult males, in distinct contrast to the majority of previous studies in the area which had recruited male and female undergraduate university students (e.g., Carver et al., 1976; Dembroski et al., 1978; Hart, 1983; Holmes et al., 1982; Manuck et al., 1978; Manuck and Garland, 1979; Pittner and Houston, 1980; Weidner and Matthews, 1978). As noted earlier, it is employed adult men who have been shown to exhibit the greatest incidence of CHD (e.g., Johnson, 1977) and for whom the association between the TABP and CHD has been demonstrated (e.g., Rosenman et al., 1964).

The use of a subject population which more closely approximated that on which the association between the TABP and CHD has been observed, rendered the findings of the studies reported here more directly relevant to the discussion of how symptom under-report may contribute to CHD than did previous research.

Another important contribution of the research reported here is that testing for between-types differences in the processing of task-peripheral stimuli was carried out within experimental paradigms and with the use of stimuli which more closely approximated the conditions under which incidental processing of symptoms may take place (see Studies 1, 4, 5, and 6) than was the case in previous studies (see Matthews and Brunson, 1979; Stern et al., 1981).

The studies reported here not only attempted to replicate previous findings, but
also sought to investigate whether Type A subjects' symptom under-report was part of a situationally elicited response or a generalized tendency. Furthermore, alternative hypotheses emphasizing situationally elicited mechanisms were tested. Research efforts were also directed at the identification of the situational characteristics capable of eliciting symptom under-report from Type A individuals. Finally, the possible implications of symptom under-report to self-regulatory behaviours were also

investigated. A extensive review of the literature revealed no other similar systematic research projects.

9.3.2 Empirical contributions

The empirical findings reported here furthered the understanding of the processes underlying Type A individuals' symptom under-report. These findings provided more clear and consistent support than was previously available for the notion that Type A individuals' symptom under-report reflects a situationally elicited response to environmental circumstances (see Studies 4, 5, and 6) rather than a generalized dispositional tendency (see Studies 2 and 3). Specifically, these studies served to provide evidence that Type A individuals' symptom under-report may be mediated by the situationally elicited restricted processing of task-peripheral visceral stimuli.

The empirical work reported in this thesis also served to identify at least some of the situational characteristics which may elicit restricted processing of visceral sensations from Type A individuals. These eliciting environmental conditions appear to involve external stimuli which are reasonably complex and which are perceived by Type A individuals as important because of their relevance to successfully mastering an ego challenge or threat.

The results of Study 6 also contributed to the understanding of the implications that Type A individuals' restricted processing of visceral stimuli may have for the prompt and efficient implementation of self-regulatory behaviours. These results suggest that during exposure to complex and important external stimuli (and due to their restricted processing of visceral stimuli), Type A subjects may exhibit an elevated viscerosomatic threshold which causes them to exert themselves beyond the level which they would normally tolerate.

9.4 Implications of the findings

The observation that during exposure to relatively complex and ego challenging (important) external stimuli Type A individuals may remain unaware of changes within the body or the full extent of these changes, has important implications for understanding the association between the TABP and CHD and for the delineation of objectives in therapeutic intervention with Type A individuals.

One conclusion that could be drawn from the results reported here is that Type A behaviour may be pathogenic not only through its association with physiological reactivity (for reviews see DeQuatro et al., 1985; Holmes, 1983; Houston, 1983; Matthews, 1982; Myrtek and Greenlee, 1984), but also through its association with the restricted processing of symptoms during exposure to difficult and ego challenging (important) external stimuli.

Restricted processing of visceral stimuli during exposure to complex and important external stimuli appears to lead Type A individuals to exert themselves significantly more than Type Bs and to exert themselves beyond the level which they would normally tolerate (see Study 6). This delay in taking self-regulatory action may cause their bodies to be subjected to greater exertion or physiological arousal than Type Bs. Furthermore, when this observation is considered in conjunction with the notion that Type A individuals may behave in such a way (albeit unwillingly) as to increase the likelihood of encountering challenges or threats (see Byrne, 1981), it is reasonable to speculate that Type A individuals may over-exert themselves, or work the organism closer to its limits more often than Type Bs.

Delay in regulating frequent and extreme demands on the organism may help to explain the association between the TABP and CHD observed in populations of employed adult males (e.g., Brand et al., 1978; De Backer et al., 1983; Rosenman et al., 1964; Rosenman et al., 1975). Type A individuals' inability to use objectively severe symptoms as cues to alter behaviour may prolong these individuals' exposure to the pathological mechanisms associated with their intense sympathetic-adrenal-medullary system activity, which includes elevations in blood pressure (BP), HR, and catecholamines (for reviews see DeQuatro et al., 1985; Glass and Contrada, 1987; Holmes, 1983; Houston, 1983; Matthews, 1982; Myrtek and Greenlee, 1984). Excessively high elevations in these indices of sympathetic-adrenal-medullary system activity have been shown to facilitate the onset of CHD (e.g., Ardlie et al., 1966; Clarkson et al., 1986; Duguid, 1946; Eliot, 1979; Friedman et al., 1981; Henry and Stephens, 1977; Herd, 1978; Kannel et al., 1970; Rosell and Belfrage, 1975; Ross and Glonsett, 1976; Williams, 1978; Williams et al., 1978).

Type A individuals' restricted processing of visceral cues of distress may also contribute to the association between the TABP and CHD by leading these individuals to delay seeking treatment during coronary events because they may adopt a more benign interpretation of symptom severity. This means that Type A individuals may reach objectively greater levels of pathology than do Type Bs, before interpreting symptoms as signs of illness requiring remedial action, the termination of activities or the alteration of routine. Support for this is not only available from the prolonged endurance of muscle contraction exhibited by Type A subjects in Study 6, but also from the observation that Type A individuals may not interpret symptoms as signs of illness (Hart, 1983) and that when ill they are more likely to attend class (Eagleston et al., 1986; Stout and Bloom, 1982) or work (Matteson and Ivancevich, 1982) and less likely to stay in bed and rest, cancel a date or take medication (Stout and Bloom, 1982) than Type Bs. Particularly relevant is the finding that during demanding and challenging circumstances, Type A individuals may fail to recognize MI pain and may delay interpreting symptoms of CHD as signs of illness requiring treatment (see Matthews et al., 1983).

The observation that Type A individuals may delay seeking treatment takes considerable importance when one considers that the speed with which treatment is received following MI is a crucial factor contributing to survival (see Doerhman, 1977; Leitch et al., 1989).

In view of the possible detrimental implications that restricted processing of visceral sensations may have, an important objective of therapeutic intervention with Type A individuals should be to promote increased awareness of visceral sensations during challenging and complex activities.

In response to early evidence that Type A individuals may not be aware of their own behaviour pattern, Rosenman and Friedman (1977) proposed that self-awareness training should be an integral part of any attempt to modify Type A behaviour. However, there are difficulties in using self awareness training to reduce the risk associated with Type A individuals' lack of symptom awareness. Type A individuals would not be able to apply what they learned in the training situation during the performance of what they consider important and complex activities. Despite self awareness training, threats or challenges faced by Type A individuals in the course of every day activities may be sufficiently strong to quickly promote task involvement and hard driving, with the resulting effect of restricting attention to symptoms.

Although the research reported in this thesis suggests that Type A individuals may not derive significant improvements in cognitive task performance as a consequence of their restricted processing of task-peripheral visceral sensations (see Studies 1, 4, 5, and 6), they may derive a significant advantage over Type Bs in the extent to which they can continue performing without feeling exhausted (see Study 6). This behaviour may be promoted by society, particularly in the work environment where its profitability (see Howard et al., 1976) would be positively reinforced. This is consistent with the view that the TABP may develop as a consequence of environments which reward and encourage the individual to work long hours and achieve more and more in less and less time without heeding the warning signals of the organism (see Jenkins et al., 1979).

In the presence of strong reinforcements (such as social recognition, monetary gain, and promotion - see Mettlin, 1976; Suinn, 1978), it may be difficult to modify behaviour that is seen by Type As as facilitating recompense. This task may be made even more difficult by Type A individuals' hypothesized belief that positive self-evaluation is largely a function of material success and their fear that they may not get their share of things worth having (see Price, 1982).

The above observations suggest that if attempts to reduce the risk associated with Type A individuals' restricted processing of visceral stimuli are to be successful, they will need to address the cognitions, fears, and needs which drive these individuals to perceive certain aspects of the environment as challenging or threatening and thus allocate attention to these aspects at the expense of visceral stimuli.

9.5 Directions for future research

An objective of future research should be to confirm that in the course of every day activities, Type A individuals' symptom under-report is underlain by situationally elicited restricted processing of visceral stimuli. Furthermore, future research should aim to confirm that the restricted processing of visceral stimuli affects 'real life' self-regulatory and remedial behaviours.

Pilot research of the type mentioned above has already been carried out by the author. However, it was not included in this thesis due to doubts about the reliability of data collection methods. The pilot data were collected by undergraduate students as part of a class project. The study consisted of a group of employed adult males keeping a symptom and activity diary in which the occurrence and severity of a list of physical symptoms were rated each night after work, for a period of five working days. In the same diary subjects were required to rate the day's work in terms of: (a) the "pressure" that was on them to "get things done"; (b) the amount of "work load" carried out during the day; (c) how "mentally demanding"; (d) "interesting"; and (e) "important" the day's activities had been.

It was hypothesized that, due to their maximal allocation of attention to important and complex activities, Type A individuals' symptom report would be inversely related to the importance attached to the day's activities and the complexity of these activities. However, the pilot study yielded inconclusive evidence in this respect. It was found that for Type B subjects, "pressure", "work load", and "mental demand" perceived in the day's activities were significantly and positively correlated with the reported occurrence and severity of symptoms. On the other hand, no significant associations were observed among Type As between ratings of daily activities and symptom report.

Given the reservations expressed above about the reliability of data collection methods in this pilot study, the investigation of situationally elicited between-types differences in the processing of symptoms outside the laboratory will have to wait to be answered by future research. It would be useful, if data were collected over a period of months, which included not only daily ratings of symptoms and activities, but information about self-regulatory and remedial actions taken during the period of the study. This may include days off work, canceled appointments, consumption of medication, and visits to medical practitioners or other health care professionals.

Future research should also address the issue of whether restricted processing of physical sensations and delayed implementation of self-regulatory and remedial action may account for the association between the TABP and CHD. However, since this may involve time consuming prospective research, it may be advisable to delay this work until consistent evidence has been obtained in respect of the replicability of findings outside the laboratory.

REFERENCES

Adam, G. (1967). Interoception and behavior: An experimental study. Budapest: Akademiai Kiado.

Adam, G. (1978). Visceroception, awareness and behavior. In G. E. Schwartz, and D. Shapiro (Eds.), Consciousness and self-regulation (Vol.2) (pp. 199-213). New York: Plenum.

Andrews, J. G. (1978). Life events stress and psychiatric illness. Psychological Medicine, 8, 545-549.

Appels, A., de Haes, W., and Schuurman, J. (1979). Een test ter meting van het 'coronary-prone behaviour pattern' type A. Nederlandsch Tijdschfrift voor de Psychologie en haar Grensgebieden, 34, 181-188.

Appels, A., Jenkins, C. D., and Rosenman, R. H. (1982). Coronary-prone behavior in the Netherlands: A cross-cultural validation study. Journal of Behavioral Medicine, 5, 83-90.

Ardlie, N. G., Glew, G., and Schwartz, C. J. (1966). Influence of catecholamines on nucleotide-induced platelet aggregation. Nature, 212, 415-417.

Astrand, I. (1960). Aerobic work capacity in men and women with special reference to age. Acta Physiologica Scandinavica, 49, Supplement 169.

Astrand, I., and Rodahl, K. (1977). Textbook of work physiology: Physiological bases of exercise. New York: McGraw-Hill.

Astrand, P. O., and Ryhming, I. (1954). A nomogram for calculation of aerobic capacity (physical fitness) from pulse rate during submaximal work. Journal of Applied Physiology, 7, 218-221.

Barefoot, J. C., Dahlstrom, W. G., and Williams, W. B. (1983). Hostility, coronary heart disease incidence, and total mortality: a 25-year follow-up study of 225 physicians. Psychosomatic Medicine, 45, 59-64.

Bass, C., and Wade, C. (1982). Type A behavior: not specifically pathogenic. Lancet, II, 1147-1149.

Benjamin, L. S. (1967). Facts and artifacts in using analysis of covariance to "undo" the law of initial values. Psychophysiology, 4(2), 187-202.

Berdina, N. A., Kolenko, O. L., Kotz, Y. M., Kuznetzov, S. P., Rodionov, I. M., Savtchenko, A. P., and Tkhorevsky, V. I. (1971). The blood flow and the performance of a skeletal muscle during emotional stress induced by mental arithmetic. Journal of Physiology of the USSR, 57, 546-555.

Berdina, N. A., Kolenko, O. L., Kotz, Y. M., Kuznetzov, S. P., Rodionov, I. M., Savtchenko, A. P., and Tkhorevsky, V. I. (1972). Increase in skeletal muscle performance during emotional stress in man. Circulation Research, 30, 642-650.

Berdina, N. A., Kolenko, O. L., Kotz, Y. M., Rodionov, I. M., and Tkhorevsky, V. I. (1971). On the functional significance of the sympathetic vasodilator effect in a skeletal muscle. Doklady Akademii Nauk USSR, 197, 1218-1221.

Bergman, L., and Magnusson, D. (1979). Overachievement and catecholamine excretion in an achievement-demanding situation. Psychosomatic Medicine, 41, 181-188.

Berkman, L. F. (1984). Assessing the physical health effects of social newtorks and social support. Annual Review of Public Health, 5, 413-432.

Blaney, N. T., Brown, P., and Blaney, P. H. (1986). Type A, marital adjustment, and life stress. Journal of Behavioral Medicine, 9(5), 491-502.

Blascovich, J., and Katkin, E. S. (1983). Visceral perception and social behavior. In J. T. Cacioppo and R. E. Petty (Eds.), Social psychophysiology: A sourcebook (pp. 493-509). New York: The Guilford Press.

Blumenthal, J. A., Williams, R. B., Kong, Y., Schanberg, S. M., and Thompson, L. W. (1978). Type A behavior pattern and coronary atherosclerosis. Circulation, 58, 634-639.

Blumenthal, J. A., Williams, R. B., Kong, Y., Thompson, L. W., Jenkins, C. D., and Rosenman, R. H. (1975). Coronary-prone behavior and angiographically documented coronary disease. Psychosomatic Medicine, 37, 79-80 (Abstract).

Borg, G. (1962). Physical performance and perceived exertion. Berlineska Boktryckeriet Lund. Studia Psychologia et Paedagogia, Series Altera Investigations, XI.

Borg, G. (1971). Psychological and physiological studies in physical work. In W. T. Singleton and D. Witfield (Eds.), Measurement of Man at Work (pp. 121-128). London: Taylor and Francis.

Borg, G., Egerman, K., Freeman, E., and Gust, T. (1969). A study of physical and perceived exertion. Reports of the Pennsylvania Rehabilitation Centre, 4 and 6.

Borg, G., and Linderholm, H. (1967). Perceived exertion and pulse rate during graded exercise in various age groups. Acta Medica Scandinavica, Supplement 472, 194 -206.

Bortner, R. W. (1969). A short rating scale as a potential measure of pattern A behavior. Journal of Chronic Diseases, 22, 87-91.

Bortner, R. W., and Rosenman, R. H. (1967). The measurement of pattern A behavior. Journal of Chronic Diseases, 20, 525-533.

Bortner, R. W., Rosenman, R. H., and Friedman, M. (1970). Familial similarity in pattern A behavior. Journal of Chronic Diseases, 23, 39-43.

Brand, R. J., Rosenman, R. H., Jenkins, C. D., Sholtz, R. I., and Zyzanski, S. J. (1978). Comparison of coronary heart disease prediction in the Western Collaborative Group Study using the Structured Interview and the Jenkins Activity Survey assessment of the coronary-prone Type A behavior pattern. (Abstract) American Heart Association Cardiovascular Disease - Epidemiology Newsletter, 24.

Brand, R. J., Rosenman, R. H., Scholtz, R. I., and Friedman, M. (1976). Multivariate prediction of coronary heart disease in the Western Collaborative Group Study compared with the findings of the Framingham Study. Circulation, 53, 348-355.

Bray, G. A. (1978). Definition, measurement and classification of the syndromes of obesity. International Journal of Obesity, 2, 99-112.

Brener, J. (1977). Sensory and perceptual determinants of voluntary visceral control. In G. E. Schwartz and J. Beatty (Eds.), Biofeedback: Theory and Research (pp. 29-66). New York: Academic Press.

Brener, J. (1978). Visceral perception. In J. Beatty (Ed.), Biofeedback and behavior: A NATO symposium. New York: Plenum.

Brener, J., and Jones, J. M. (1974). Interoceptive discrimination in intact humans: detection of cardiac activity. Physiological Behavior, 13, 763-767.

Broadbent, D. E. (1958). Perception and communication. New York: Permagon.

Bronte-Stewart, B., Keyes, A., and Brock, J. F. (1955). Serum cholesterol, diet and coronary heart disease: An inter-racial survey in the Cape Peninsula. Lancet, II, 1103-1108.

Brunson, B. I., and Matthews, K. A. (1981). The Type A coronary-prone behavior pattern and reactions to uncontrollable stress: An analysis of performance strategies, affect, and attributions during failure. Journal of Personality and Social Psychology, 40, 906-918.

Buell, J. C., and Sime, W. F. (1979). Quantification of physiological response to emotional stress. Journal of the South Carolina Medical Association, 25, 555-561.

Burger, M. (1985). Desire for control and achievement-related behaviours. Journal of Personality and Social Psychology, 48, 1520-1533.

Burke, R. J. (1984). Beliefs and fears underlying Type A behavior: what makes Sammy run - so fast and aggressively. Journal of Human Stress, 10(4), 174-182.

Burke, R. J. , and Weir, T. (1980). The Type A experience: occupational and life demands, satisfaction and well being. Journal of Human Stress, 6(4), 28-38.

Burke, R. J. , Weir, T, and DuWors, R. E. (1979). Type A behavior of administrators and wives' reports of marital satisfaction and well-being. Journal of Applied Psychology, 64, 57-65.

Burnam, M. A., Pennebaker, J. W., and Glass, D. C. (1975). Time consciousness, achievement striving, and the type A coronary-prone behavior pattern. Journal of Abnormal Psychology, 84(1), 76-79.

Buss, D. M. (1980). Self-Consciousness and Social Anxiety. San Francisco: W. H. Freeman and Company.

Buss, D. M., and Scheier, M. F. (1976). Self-consciousness, self-awareness, and self-attribution. Journal of Research in Personality, 10, 463-468.

Byrne, D. G. (1981). Type A behaviour, life events and myocardial infarction: Independent or related risk factors?. British Journal of Medical Psychology, 54, 371-377.

Byrne, D. G. (1987). Personality, life events and cardiovascular disease. Journal of Psychosomatic Research, 31(6), 661-671.

Byrne, D. G., and Reinhart, M. I. (1989). Work characteristics, occupational achievement and the Type A behaviour pattern. Journal of Occupational Psychology, 62, 123-134.

Byrne, D. G., and Rosenman, R. H. (1986). Type A behaviour and the experience of affective discomfort. Journal of Personality Research, 30(6), 663-672.

Byrne, D. G., Rosenman, R. H., Schiller, E., and Chesney, M. A. (1985). Consistency and variation among instruments purporting to measure the Type A behaviour pattern. Psychosomatic Medicine, 47, 242-261.

Byrne, D. G., and Whyte, H. M. (1980). Life events and myocardial infarction revisited: The role of measures of individual impact. Psychosomatic Medicine, 42, 1-10.

Caffrey, B. (1968). Reliability and validity of personality and behavioral measures in a study of coronary heart disease. Journal of Chronic Diseases, 21, 191-204.

Caffrey, B. (1969). Behavior patterns and personality characteristics related to prevalence of coronary heart disease in American monks. Journal of Chronic Diseases, 22, 93-103.

Caffrey, B. (1970). A multivariate analysis of psychophysiological factors in monks with myocardial infarctions. American Journal of Public Health, 60, 452-461.

Carver, C. S. (1974). Facilitation of physical aggression through objective self awareness. Journal of Experimental Social Psychology, 10, 365-370.

Carver, C. S. (1975). Physical aggression as a function of objective self-awareness and attitudes toward punishment. Journal of Experimental Social Psychology, 11, 570-579.

Carver, C. S. (1980). Perceived coercion, resistance to persuasion and the Type A behavior pattern. Journal of Research in Personality, 14, 467-481.

Carver, C. S., Coleman, A. E., and Glass, D. C. (1976). The coronary prone behavior pattern and the suppression of fatigue on a treadmill test. Journal of Personality and Social Psychology, 33(4), 460-466.

Carver, C. S., DeGregorio, E., and Gillis, R. (1981). Challenge and Type A behaviour among intercollegiate football players. Journal of Sport Psychology, 3, 140-148.

Carver, C. S., and Glass, D.C. (1976). The self-consciousness scale: A discriminant validity study. Journal of Personality Assessment, 40(2), 169-172.

Carver, C. S., and Glass, D.C. (1978). Coronary-prone behavior pattern and interpersonal aggression. Journal of Personality and Social Psychology, 36, 361-366.

Carver, C. S., and Scheier, M. F. (1978). Self-focusing effects of dispositional self-consciousness, mirror presence and audience presence. Journal of Personality and Social Psychology, 36(3), 324-332.

Carver, C. S., and Scheier, M. F. (1981). Attention and self-regulation: A control theory approach to human behavior. New York: Springer-Verlag.

Carver, C. S., and Scheier, M. F. (1982). Control theory: A useful conceptual framework for personality-social, clinical and health psychology. Psychological Bulletin, 92, 111-135.

Case, R. B., Heller, S. S., Case, N. B., Moss, M. and The Multicenter Post-Infarction Research Group (1985). Type A behavior and survival after MI. New England Journal of Medicine, 312, 737-741.

Chernigovskiy, V. N. (1967). Interoceptors. Americal Psychological Association: Washington D. C.

Chesney, M. A., Black, G. W., Chadwick, J. H., and Rosenman, R. H. (1981). Psychological correlates of the coronary-prone behavior pattern. Journal of Behavioral Medicine, 4, 217-230.

Chesney, M. A., Eaglestone, J. R., and Rosenman, R. H. (1980). The Type A structured interview: A behavioral assessment in the rough. Journal of Behavioral Assessment, 2, 255-272.

Chesney, M. A., Eaglestone, J. R., and Rosenman, R. H. (1981). Type A behavior: Assessment and intervention. In C. K. Prokop, and L. A. Bradley (Eds.), Medical Psychology: Contributions to behavioral medicine (pp. 191-198). New York: Springer-Verlag.

Child, D. (1976). Essentials of factor analysis. London: Holt, Rhinehart and Winston.

Claridge, G. S. (1967). Personality and Arousal. Oxford: Permagon Press.

Clarkson, T. B., Kaplan, J. R., and Manuck, S. B. (1986). The role of reactivity to stress in atherosclerosis. In K. A. Matthews, S. M. Weiss and T. Detre (Eds.), Handbook of stress, reactivity, and cardiovascular disease (pp. 35-47). New York: John Wiley and Sons.

Coburn, D. (1975). Job-worker incongruence: Consequences for health. Journal of Health and Social Behavior, 16, 198-212.

Cohen, J. B. (1974). Sociocultural change and behavior patterns in disease etiology: An epidemiologic study of coronary disease among Japanese Americans. Unpublished Doctoral Dissertation, University of California at Berkeley.

Cohen, J. B. (1978). The influence of cultures on coronary-prone behavior. In T. M. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 191-198). New York: Springer-Verlag.

Cohen, J. B., Matthews, K. A., and Waldron, I. (1978). Coronary-prone behavior: Developmental and cultural considerations. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 184-190). New York: Springer-Verlag.

Cohen, J. B., and Reed, D. (1958). Type A behavior and coronary heart disease among Japanese men in Hawaii. Journal of Behavioral Medicine, 8, 343-352.

Cohen, J. B., Syme, S. L., Jenkins, C. D., Kagan, A., and Zyzanski, S. J. (1979). Cultural context of Type A behavior and risk for CHD: A study of Japanese American males. Journal of Behavioral Medicine, 2, 375-384.

Cohen, J. B., and Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. Psychological Bulletin, 98, 310-357.

Connoly, J. (1976). Life events before myocardial infarction. Journal of Human Stress, 2,3-17.

Contrada, R. J., Glass, D. C., Krakoff, L. R., Krantz, D. S., Kehoe, K., Isecke, W., Collins, C., and Elting, E. (1982). Effects of control over aversive stimulation and Type A behaviour on cardiovascular and plasma catecholamine responses. Psychophysiology, 19, 408-419.

Cook, W. W., and Medley, D. M. (1954). Proposed Hostility and Pharisaic-Virtue Scales for the MMPI. Journal of Applied Psychology, 38, 414-418.

Cooper, T., Detre, T., and Weiss, S. M. (1981). Coronary-prone behavior and coronary heart disease: A critical review. Circulation, 63, 1199-1215.

Crigg, L. J. (1984). Learning mechanisms in heart rate control: The role of heart rate discrimination. Unpublished Doctoral Dissertation. University of Queensland.

D'Amato, M. R. (1970). Experimental Psychology: Methodology, psychophysics, and learning. New York: McGraw-Hill.

Davidson, R. J., Horowitz, M. E., Schwartz, G. E., and Goodman, D. M. (1981). Lateral differences in the latency between finger tapping and the heart beat. Psychophysiology, 18, 36-41.

DeBacker, G., Kornitzer, M., Kittel F., Bogaert, M., Van Durme, J. P., Vincke, J., Rustin, R. M., Degre, C., and De Schaepdrijver, A. (1979). Relation between coronary-prone behavior pattern, excretion of urinary catecholamines, heart rate, and heart rhythm. Preventive Medicine, 8, 14-22.

DeBacker, G., Kornitzer, M., Kittel F., and Dramaix, M. (1983). Behavior, stress and psychosocial traits as risk factors. Preventive Medicine, 12, 32-36.

DeBacker, G., Kornitzer, M., Thilly, C., and Depoorter, A. M. (1977). The Belgian Multifactor preventive trial in CVD (I). Design and Methodology. Heart Bulletin, 8, 143-146.

Dembroski, T. M., and Costa, P. T. (1987). Coronary prone behavior: Components of the Type A pattern and hostility. Journal of Personality, 55(2), 211-235.

Dembroski, T. M., MacDougall, J. M., Herd, J. A., and Shields, J. L. (1979). Effects of level of challenge on pressor and heart rate responses in Type A and B subjects. Journal of Applied Social Psychology, 9, 208-228.

Dembroski, T. M., MacDougall, J. M., and Musante, L. (1984). Desirability of control versus locus of control: Relationship of paralinguistics in the Type A interview. Health Psychology, 3, 15-26.

Dembroski, T. M., MacDougall, J. M., and Shields, J. L. (1977). Physiologic reactions to the social challenge in persons evidencing the Type A coronary-prone behavior pattern. Journal of Human Stress, 3(3), 2-9.

Dembroski, T. M., MacDougall, J. M., Shields, J. L., Petitto, J., and Lushene, R. (1978). Components of the Type A coronary-prone behavior pattern and cardiovascular responses to psychomotor performance challenge. Journal of Behavioral Medicine, 1(2), 159-176.

Dembroski, T. M., MacDougall, J. M., Williams R. B., Haney, T., and Blumenthal, J. A. (1985). Components of Type A, hostility, and anger-in: relationship to angiographic findings. Psychosomatic Medicine, 47, 219-233.

DeMeersman, R. E., Schaefer, D. C., and Miller, W. W. (1984). Personality and self-motivation during biochemical fatigue. Journal of Human Stress, 10(3), 146-150.

DeQuatro, V., Loo, R., and Foti, A. (1985). Sympathoadrenal responses to stress: The linking of Type A behavior pattern to ischemic heart disease. Clinical and Experimental Theory and Practice, A7(4), 469-481.

Dimsdale, J. E., Hackett, T. P., Catanzano, D. M., and White, P. J. (1979). The relationship between diverse measures for Type A personality and coronary angiographic findings. Journal of Psychosomatic Research, 23, 289-293.

Dimsdale, J. E., Hackett, T. P., Hutter, A. M. Jr., Block, P. C., and Catanzano, D. M. (1978). Type A personality and extent of coronary atherosclerosis. American Journal of Cardiology, 42, 583-86.

Dimsdale, J. E., Hackett, T. P., Hutter, A. M. Jr., Block, P. C., Catanzano, D. M., and White, P. J. (1979). Type A behavior and angiographic findings. Journal of Psychosomatic Research, 23, 273-276.

Doehrman, S. R. (1977). Psychosocial aspects of recovery from coronary heart disease: A review. Social Science and Medicine, 11, 199-218.

Dohrenwend, B. S., and Dohrenwend, B. P. (Eds). (1974). Stressful life events. New York: Wiley and Sons.

Duguid, J. B. (1946). Thrombosis as a factor in the pathogenesis of coronary atherosclerosis. Journal of Pathological Bacteriology, 58, 207-212.

Dunbar, F. (1943). Psychosomatic Diagnosis. New York: Hoeber and Harper.

Duncan, J. W., and Lair, J. D. (1980). Positive and reverse placebo effects as a function of differences in cues used in self-perception. Journal of Personality and Social Psychology, 39, 1024-1036.

Duval, S., and Wicklund, R. A. (1972). A theory of objective self-awareness. New York: Academic Press.

Duval, S., and Wicklund, R. A. (1973). Effects of objective self-awareness on the attribution of causality. Journal of Experimental Social Psychology, 9, 17-31.

Eagleston, J. R., Kirmil-Gray, K., Thoresen, C. E., Wiedenfeld, S. A., Bracke, P., Heft, L., and Arnow, B. (1986). Physical health correlates of Type A behavior in children and adolescents. Journal of Behavioral Medicine, 9(4), 341-362.

Easterbrook, J. A. (1959). The effect of emotion on cue utilization and organization of behavior. Psychological Review, 66, 183-201.

Ekblom, B., and Goldberg, A. N. (1971). The influence of physical training and other factors on the subjective rating of perceived exertion. Acta Physiologica Scandanavica, 83, 399-406.

Eliot, R. S. (1978). Stress and major cardiovascular disorders. New York: Futura Publishing.

Elmadjian, F. (1963). Excretion and metabolism of epinephrine and norepinephrine in various emotional states. Proceedings of the 5th Pan American Congress on Endocrinology (pp. 341-370). Lima, Peru.

Engel, G. L. (1970). Sudden death and the "medical model" in psychiatry. Canadian Psychiatric Association Journal, 15, 527-538.

Evans, G. W., Palsane, M. N., and Carrere, S. (1987). Type A behavior and occupational stress: A cross-cultural study of blue-collar workers. Journal of Personality and Social Psychology, 52(5), 1002-1007.

Evans, P. D., and Moran, P. (1987). Cardiovascular unwinding, Type A behaviour and locus of control. British Journal of Medical Psychology, 60, 261-265.

Eysenck, J. H. (1975). The measurement of emotion: psychological parameters and methods. In L. Levi (Ed.), Emotions: Their parameters and measurement (pp. 439-467). New York: Raven Press.

Falger, P. (1983). Behavioral factors, life changes and the development of vital exhaustion in myocardial infarction patients. International Journal of Behavioral Development, 6, 405-425.

Falger, P., Bressors, I., and Dijkstra, P. (1980). Levensloop patronen van hartinfarct patienten en van controlegroegen: Enkele overeekomsten en verschillen. Gerontologie, 11, 240-257.

Fazio, R. H., Cooper, M., Dayson, K., and Johnson, M. (1981). Control and the coronary-prone behavior pattern: Responses to multiple situational demands. Personality and Social Psychology Bulletin, 7(1), 97-102.

Fenigstein, A. (1974). Self-consciousness, self-awareness and rejection. Unpublished Doctoral Dissertation, The University of Texas at Austin.

Fenigstein, A., Scheier, M. F., and Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. Journal of Consulting and Clinical Psychology, 43(4), 522-527.

Fontana, A., and Dovidio, J. F. (1984) The relationship between stressful life events and school-related performances of Type A and Type B adolescents. Journal of Human Stress, 10(1), 50-55.

Frank, K. A., Heller, S. S., Konfeld, D. S., Sporn, A. A. and Weiss, M. D. (1978). Type A behavior pattern and coronary atherosclerosis. Journal of the American Medical Association, 240, 761-763.

Frankenhauser, M. (1975). Experimental approaches to the study of catecholamines and emotion. In L. Levi (Ed.), Emotions: Their parameters and measurement (pp. 209-234). New York: Raven Press.

Frankenhauser, M. (1980). Psychoneuroendocrine approaches to the study of stressful person-environment transactions. In H. Selye (Ed.), Guide to stress research (Vol. 1) (pp. 46-70). New York: Van Nostrand-Reinhold.

Frankenhauser, M., and Kareby, S. (1962). Effect of meprobamate on catecholamine excretion during mental stress. Perceptual and Motor Skills, 15, 571-577.

Frankenhauser, M., Lundberg, U., and Forsman, L. (1980). Dissociation between sympathetic-adrenal and pituitary adrenal responses to an achievement situation characterized by high controllability: comparison between Type A and Type B males and females. Biological Psychology, 10, 79-91.

Frankenhauser, M., and Post, B. (1962). Catecholamine excretion during mental work as modified by centrally acting drugs. Acta Physiologica Scandinavica, 55, 74-81.

French-Belgian Collaborative Group (1982). Ischemic heart disease and psychological patterns : prevalence and incidence studies in Belgium and France. Advances in Cardiology, 29, 25-31.

Friedman, M., Byers, S. O., Diamant, J., and Rosenman, R. H. (1975). Plasma catecholamine response of coronary-prone subjects (Type A) to a specific challenge. Metabolism, 24, 215-210.

Friedman, M., and Rosenman, R. H. (1957). Comparison of fat intake of American men and women: Possible relationship to incidence of clinical coronary artery disease. Circulation, 16, 339-347.

Friedman, M., and Rosenman, R. H. (1959). Association of specific overt behavior pattern with blood and cardiovascular findings. Journal of the American Medical Association, 169, 1286-1296.

Friedman, M., and Rosenman, R. H. (1960). Overt behavior pattern in coronary disease: Detection of overt behavior pattern in patients with coronary disease by a new psycho-physiological procedure. Journal of the American Medical Association, 173, 1320-1325.

Friedman, M., and Rosenman, R. H. (1971). Type A behavior pattern: Its association with coronary heart disease. Annals of Clinical Research, 3, 300-312.

Friedman, M., and Rosenman, R. H. (1974). Type A behavior and your heart. New York: Knopf.

Friedman, M., Rosenman, R. H., and Byers, S. O. (1964). Serum lipids and conjunctival circulation after fat ingestion in men exhibiting Type A behavior pattern. Circulation, 29, 874-886.

Friedman, M., Rosenman, R. H., and Carrol, V. (1958). Changes in serum cholesterol and blood clotting time in men subjected to cyclic variations in occupational stress. Circulation, 169, 1085-1096.

Friedman, M., St. George, S., and Byers, S. O., and Rosenman, R. H. (1960). Excretion of catecholamines, 17-Ketosteroids, 17-hydroxy-corticoids, and 6-hydroxy indole in men exhibiting a particular behavior pattern (A) associated with high incidence of clinical coronary artery disease. Journal of Clinical Investigation, 39, 758-764.

Friedman, M., Thoresen, C. E., and Gill, J. J., (1981). Type A behavior: Its possible role, detection, and alteration in patients with ischemic heart disease. In J. W. Hurst (Ed.), Update Five: The heart. New York: McGraw-Hill.

Friedman, M., Thoresen, C. E., Gill, J. J., Powell, L. H., Ulmer, D., Thompson, L., Price, V. A., Rabin, D. D., Breall, W. S., Dixon, T., Levy, R., and Bourg, E. (1984). Alteration of Type A behavior and reduction in cardiac recurrences in postmyocardial infarction patients. American Heart Journal, 108(2), 237-248.

Friedman, M., Thoresen, C. E., Gill, J. J., Ulmer, D., Thompson, L., Powell, L., Price, V., Elek, S. R., Rabin, D. R., Breall, W. S., Piaget, G., Dixon, T., Bourg, E., Levy, R. A., and Tasto, D. L. (1982). Feasibility of altering the Type A behavior pattern after myocardial infarction. Circulation, 66, 83-92.

Garrity, T. F. (1981). Behavioral adjustment after myocardial infarction: A selective review of recent descriptive, correlational and intervention research. In S. M. Weiss, J. A. Herd, and B. H. Fox (Eds.), Perspectives on behavioral medicine (pp. 67-87). New York: Academic Press.

Gastorf, J. W. (1980). Time urgency of the Type A behavior pattern. Journal of Consulting and Clinical Psychology, 49, 299.

Gastorf, J. W., and Teevan, R. C. (1980). Type A coronary-prone behaviour pattern and fear of failure. Motivation and Emotion, 4(1), 71-76.

Gentry, W. D., Oude-Weme, J. D., Musch, F., and Hall, R. D. (1981). Differences in Type A behavior in response to acute myocardial infarction. Heart and Lung, 10, 1101-1105.

Gibbons, F. X., Carver, C. S., Scheier, M. F., and Hormuth, S. E. (1979). Self-focused attention and the placebo effect: Fooling some of the people some of the time. Journal of Experimental Social Psychology, 15, 263-274.

Gilhooly, K. J., and Hay, D. (1977). Imagery, concreteness, age of acquisition, familiarity, and meaningfulness values for 205 five-letter words having single-solution anagrams. Behavior Research Methods and Instrumentation, 9(1), 12-17.

Glass, D. C. (1977). Behavior patterns, stress and coronary disease. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Glass, D. C., and Contrada, R. S. (1987). Type A behavior and catecholamines: A critical review. In C. R. Lake, and M. Zeigler (Eds.), Norepinephrine: Clinical Aspects (pp. 346-367). Baltimore: Williams and Williams.

Glass, D. C., Krakoff, L. R., Contrada, R., Hilton, W. F., Kehoe, K., Mannucci, E. G., Collins, C., Snow, B., and Elting, E. (1980). Effect of harassment and competition upon cardiovascular and plasma catecholamine responses in Type A and Type B individuals. Psychophysiology, 17(5), 453-463.

Glass, D. C., Krakoff, L. R., Finkelman, G., Snow, B., Contrada, R., Kehoe, K., Mannucci, E. G., Isecke, W., Collins, C., Hilton, W. F., and Elting, E. (1980). Effect of task overload upon cardiovascular and plasma catecholamine responses in Type A and B individuals. Basic Applied Social Psychology, 1, 199-218.

Glass, D. C. Snyder, M. L., and Hollis, J. F. (1974). Time urgency and the Type A coronary behavior pattern. Journal of Applied Social Psychology, 4, 125-140.

Gofman, J. W., Hanig, M., Jones, H. B., Lauffer, M. A., Lowry, E. Y., Lewis, L. A., Mann, G. V., Moore, F. E., Olmstead, F., Yeager, J. F., Andrus, E. C., Barach, J. H., Beams, J. W., Fertig, J. W., Page, I. H., Shannon, J. A., Stare, F. J., and White, P. D. (1956). Evaluation of serum lipoprotein and cholesterol measurements as predictors of clinical complications of atherosclerosis. Circulation, 14, 691-741.

Goldband, S. (1980). Stimulus specificity of physiological response to stress and the Type A coronary-prone behavior pattern. Journal of Personality and Social Psychology, 39(4), 670-679.

Grimm, L. G., and Yarnold, P. R. (1984). Performance standards and the Type A behaviour pattern. Cognitive Therapy and Research, 8(1), 59-66.

Hantas, M., Katkin, E. S., and Blascovitch, J. (1982). Relationship between heartbeat discrimination and subjective experience of affective state (Abstract). Psychophysiology, 19, 563.

Hantas, M., Katkin, E. S., and Reed, S. D. (1984). Heartbeat discrimination training and cerebral lateralization. Psychophysiology, 21, 274-278.

Harrison, R. (1976). Job stress as person-environment fit. Paper presented at the meeting of the American Psychological Association, Washington DC.

Hart, K. E. (1983). Physical symptom reporting and health perception among Type A and B college males. Journal of Human Stress, 9, 17-22.

Hart, K. E., and Jamieson, J. L. (1983). Type A behaviour and cardiovascular recovery from a psychosocial stressor. Journal of Human Stress, 9, 18-24.

Hartley, L. R., and Adams, R. G. (1974). Effect of noise on the Stroop test. Journal of Experimental Psychology, 102, 62-66.

Hatch, F. R., Reisell, P. K., Poon-King, T. M. W., Cannellas, G. P., Lees, R. S., and Hagopian, L. M. (1966). A study of coronary heart disease in young men: Characteristics and metabolic studies of patients and comparison with age-match healthy men. Circulation, 33, 679-703.

Haynes, S. G., and Feinleib, M. (1982). Type A behavior and the incidence of coronary heart disease in the Framingham Heart Study. Advances in Cardiology, 29, 85-95.

Haynes, S. G., Feinleib, M., and Kannel, W. B. (1980). The relationship of psychosocial factors to coronary heart disease in the Framingham Study: (III): Eight-year incidence of coronary heart disease. American Journal of Epidemiology, 111, 137-158.

Haynes, S. G., Levine, S., Scotch, N., Feinleib, M., and Kannel, W. B. (1978). The relationship of psychosocial factors to coronary heart disease in the Framingham Study: (I) : Methods and risk factors. American Journal of Epidemiology, 107, 362-383.

Hecker, M., Frautschi, N., Chesney, M., Black, G., and Rosenman, R. (1985). Components of Type A behavior and coronary heart disease. Paper presented at the meeting of the Society of Behavioral Medicine, New Orleans, LA., U.S.A.

Heller, R. F. (1979). Type A behaviour and coronary heart disease. British Medical Journal, 2, 368.

Henry, J. P., and Stephens, P. M. (1977). Stress, health and the social environment. New York: Springer-Verlag.

Herbertt, R. M. (1983). A critical evaluation of some commonly employed methods for the assessment of Type A coronary-prone behaviour. Personality and Individual Differences, 4(5), 451-456.

Herbertt, R. M., and Innes, S. M. (1982). Type A coronary-prone behaviour pattern, self-consciousness, and self-monitoring: A questionnaire study. Perceptual and Motor Skills, 55, 471-478.

Herd, J. A. (1978). Physiological correlates of coronary-prone behavior. In T.M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 129-136). New York: Springer-Verlag.

Herman, S., Blumenthal, J. A., Black, G. M., and Chesney, M. A. (1981). Self-ratings of Type A (coronary-prone) adults: Do Type A's know they are Type A's? Psychosomatic Medicine, 43(5), 405-413.

Hiland, D. (1977). Behavioral characteristics of male VA patients with and without coronary heart disease. Unpublished Doctoral Dissertation, University of South Florida.

Hill, A. B. (1965). The environment and disease: association or causation. Proceedings of the Royal Society of Medicine., 58, 295-300.

Hirata, K. and Kaku, K. (1968). The evaluating method of physique and physical fitness and its practical applications. Gife City: Haifu Institute of Health.

Holmes, D. S. (1983). An alternative perspective concerning the differential psychophysiological responsivity of persons with the Type A and B behavior patterns. Journal of Research in Personality, 17, 40-47.

Holmes, D. S., Solomon, S., and Rump, B. S. (1982). Cardiac and subjective response to cognitive challenge and to controlled physical exercise by male and female coronary prone (Type A) and non-coronary prone persons. Journal of Psychosomatic Research, 26, 309-316.

Houston, B. K. (1983). Psychophysiological responsivity and the Type A behavior pattern. Journal of Research in Personality, 17, 22-39.

Houston, B. K., and Kelly, K. E. (1987). Type A behavior in housewives: Relation to work, marital adjustment, stress, tension, health, fear-of-failure and self esteem. Journal of Psychosomatic Research, 31(1), 55-61.

Howard, J. H., Cunningham, D. A., and Rechnitzer, P. A. (1976). Health patterns associated with Type A behavior: A managerial population. Journal of Human Stress, 10, 24-31.

Howard, J. H., Cunningham, D. A., and Rechnitzer, P. A. (1986). Personality (hardiness) as a moderator of job stress and coronary risk in Type A individuals: A longitudinal study. Journal of Behavioral Medicine, 9(3), 229-244.

Howland, E. W., and Siegman, A. W. (1982). Toward the automated measurement of the Type A behavior pattern. Journal of Behavioral Medicine, 5, 37-54.

James, W. (1884). What is emotion?. Mind, 9, 188-205.

James, W. (1976). What is emotion?. In S. W. Porges and M. G. H. Coles (Eds.), Psychophysiology (pp. 253-270). Stroudsberg, Pa.: Dowden, Hutchinson and Ross.

Jenkins, C. D. (1976). Recent evidence supporting psychological and social risk factors for coronary heart disease. New England Journal of Medicine, 294, 987-994, 1033-1038.

Jenkins, C. D. (1978). A comparative review of the interview and questionnaire methods in the assessment of the coronary-prone behavior pattern. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes, and M. Feinleib (Eds.), Coronary-prone behavior (pp. 71-88). New York: Springer-Verlag.

Jenkins, C. D. , Rosenman, R. H., and Friedman, M. (1968). Replicability of rating the coronary-prone behaviour pattern. British Journal of Preventive Social Medicine, 22, 16-22.

Jenkins, C. D. , Rosenman, R. H., and Zyzanski, S. J. (1965). The Jenkins Activity Survey for Health Prediction. Chapel Hill, N.C.: C. David Jenkins.

Jenkins, C. D. , Rosenman, R. H., and Zyzanski, S. J. (1974). Prediction of clinical coronary heart disease by a test for the coronary-prone behaviour pattern. English Journal of Medicine, 23, 1271-1275.

Jenkins, C. D., and Zyzanski, S. J. (1982). The type A behaviour pattern is alive and well - when not dissected: A reply. British Journal of Medical Psychology, 55, 219-223.

Jenkins, C. D., Zyzanski, S. J., and Rosenman, R. H. (1971). Progress towards validation of a computer-scored test for the Type A coronary-prone behavior pattern. Psychosomatic Medicine, 33, 193-202.

Jenkins, C. D., Zyzanski, S. J., and Rosenman, R. H. (1976). Risk of new myocardial infarction in middle-aged men with manifest coronary heart disease. Circulation, 53, 342-347.

Jenkins, C. D., Zyzanski, S. J., and Rosenman, R. H. (1971). Manual for the Jenkins Activity Survey. New York: Psychological Corporation.

Jenkins, C. D., Zyzanski, S. J., Rosenman, R. H., and Cleveland, G. L. (1979). Association of coronary-prone behavior scores with the recurrence of coronary heart disease. Journal of Chronic Diseases, 24, 601-611.

Jennings, J. R., Berg, W. K., Hutcheson, J. S., Obrist, P., Porges, S., and Turpin, G. (1981). Publication guidelines for heart rate studies in man. Psychophysiology, 18, 226-231.

Jennings, J. R., and Choi, S. (1981). Type A components and psychophysiological responses to an attention-demanding performance task. Psychosomatic Medicine, 43(6), 475-487.

Johansson, G. (1973). Activation, adjustment, and sympathetic-adrenal medullary activity: Field and laboratory studies of adults and children. Reports from the Psychological Laboratories, University of Stockholm, Supplement 21.

Johnson, A. (1977). Sex differences in coronary heart disease: The explanatory role of primary risk factors. Journal of Health and Social Behavior, 18, 46-54.

Jones, G. E., and Hollandsworth, J. G. (1982). Heart rate discrimination before and after exercise-induced augmented cardiac activity. Psychophysiology, 18, 252-257.

Jones, K. V. (1985a). Type A and academic performance: A negative relationship? Psychological Reports, 56, 260.

Jones, K. V. (1985b). The thrill of victory: Blood-pressure variability and the Type A behavior pattern. Journal of Behavioral Medicine, 8(3), 277-285.

Jones, K. V., Copolov, D. L., and Outch, K. H. (1986). Type A, test performance and salivary cortisol. Journal of Psychosomatic Research, 30(6), 699-707.

Kahneman, D. (1973). Attention and effort. Englewood Cliffs, N. J..: Prentice-Hall.

Kannel, W. B., Gordon, T., Castelli, W. P., and Margolis, J. R. (1970). Electrographic left ventricular hypertrophy and risk of coronary heart disease. The Framingham Study. Annals of Internal Medicine , 72, 813-822.

Katkin, E. S. (1985). Blood, sweat and tears: Individual differences in autonomic self-perception. Psychophysiology, 23(2), 125-135.

Katkin, E. S., Blascovich, J., and Goldband, S. (1981). Empirical assessment of visceral self-perception: Individual and sex differences in the acquisition of heartbeat discrimination. Journal of Personality and Social Psychology, 40, 1095-1101.

Katkin, E. S., Blascovich, J., Reed, S. D., Adamec, J., Jones, J., & Taublieb, A. (1982). The effect of psychologically induced arousal on accuracy of heartbeat self perception (Abstract). Psychophysiology, 19, 568.

Katkin, E. S., Morell, M. A., Goldband, S., and Bernstein, G. L. (1980). Individual differences in visceral and external signal discrimination. Psychophysiology, 17, 322-323.

Kavanagh, T. and Shephard, R. J. (1976). Maximum exercise tests on "postcoronary" patients. Journal of Applied Physiology, 40, 611-618.

Keegan, D. L., Sinha, B. N., Merriman, J. E., and Shiplay, C. (1979). Type A behavior pattern: Relationship to coronary heart disease, personality, and life adjustment. Canadian Journal of Psychiatry, 24, 724-730.

Keil, P. G., and MacVay, L. V. (1956). A comparative study of myocardial infarction in the white and negro races. Circulation, 13, 712-718.

Keith, R. A., Lown, B., and Stare, F. J. (1965). Coronary heart disease and behavior patterns. Psychosomatic Medicine, 27, 424-427.

Kemple, C. (1945). Rorschach method and psychosomatic diagnosis: Personality traits of patients with rheumatic disease, hypertensive cardiovascular disease, coronary occlusion and fracture. Psychosomatic Medicine, 7, 85.

Kenigsberg, D., Zyzanski, S. J., Jenkins, C. D., Wardell, W. I., and Licciardello, A. T. (1974). The coronary-prone behavior pattern in hospitalized patients with and without coronary heart disease. Psychosomatic Medicine, 36, 344-351.

Keys, A. (1954). Symposium on atherosclerosis. National Academy of Sciencies Publication 338, 28-36, Washington.

Kinsman, R. A., and Staudenmayer, H. (1978). Baseline levels in muscle relaxation training. Biofeedback and Self-Regulation, 3(1), 97-104.

Kirk, R. E. (1982). Experimental design: Procedures for the behavioral sciences. Belmont, California: Brooks/Cole Publishing Company.

Kittel, F., Kornitzer, M., Zyzanski, S. J., Jenkins, C. D., Rustin, R. M., and Degre, C. (1978). Two methods of assessing the Type A coronary-prone behaviour pattern in Belgium. Journal of Chronic Diseases, 31, 147-155.

Kornitzer, M., Kittel, F., De Backer, G., and Dramaix, M. (1981). The Belgian Heart Disease Prevention Project: Type "A" behaviour pattern and the prevalence of coronary heart disease. Psychosomatic Medicine, 43(2), 133-145.

Kornitzer, M., Magotteau, C., Degre, C., Kittel, J. and Van Thiel, E. (1982). Angiographic findings and the Type A pattern assessed by means of the Bortner Scale. Journal of Behavioral Medicine, 5, 313-320.

Kotz, Y. M., Rodionov, I. M., Sitnikov, B. F., Tkhorevsky, V.I., and Vinogradova, O. L. (1978). On the mechanism of an increase of muscle performance and of vasodilation during emotional stress in man. Pflugers Archives (European Journal of Physiology), 373, 211-218.

Krantz, D.S., Glass, D.C., Schaeffer, M. A., and Davia J. E. (1982). Behaviour pattern and coronary disease: A critical evaluation. In J. T. Cacioppo and R. E. Petty (Eds.), Perspectives in cardiovascular psychophysiology (pp. 315-346). New York: Guildford Press.

Krantz, D.S., Glass, D.C., and Snyder, M.L. (1974). Helplessness, stress levels, and the coronary-prone behaviour pattern. Journal of Experimental Social Psychology, 10, 284-300.

Krantz, D. S., Sanmarco, M. I., Selvester, R. H., and Matthews, K. A. (1979). Psychological correlates of progression of atherosclerosis in men. Psychosomatic Medicine,41, 467-475.

Krantz, D. S., Schaeffer, M. A., Davia, J. E., Dembroski, T. M., MacDougall, J. M., and Shaffer, R. T. (1981). Extent of coronary atherosclerosis, Type A behaviour, and cardiovascular response to social interaction. Psychophysiology, 18(6), 654-664.

Lamb, D. R. (1984). Physiology of exercise responses and adaptations. Second Edition, MacMillan Publishing: New York.

Langeluddecke, P., Fulcher, G., Jones, M., and Tennant, C. (1988). Type A behaviour and coronary atherosclerosis. Journal of Psychosomatic Research, 32(1), 77-84.

Larson, L. A. (1974). Fitness, health, and work capacity: International standards for assessment. New York: Macmillan.

Lee, C., and Innes, J. M. (1983). Type A behavior pattern, time urgency and arrival time: A replication. Perceptual and Motor Skills, 56, 177-178.

Leitch, J. W., Birbara, T., Freedman, B., Wilcox, I., and Harris, P. J. (1989). Factors influencing the time from onset of chest pain to arrival at hospital. The Medical Journal of Australia, 150, 6-9.

Leventhal , H., Nerenz, D. R., and Strauss, A. (1982). Self-regulation and the mechanisms for symptom appraisal. In D. Mechanic (Ed.), Psychosocial Epidemiology. New York: Neale Watson Academic Publication.

Levi, L. (Ed.) (1971). Society, stress and disease, Vol. 1,: The psychosocial environment and psychosomatic disease. London: Oxford University Press.

Liljfors, I., and Rahe, R. H. (1970). An identical twin study of psychosocial factors in coronary heart disease in Sweden. Psychosomatic Medicine, 32(5), 523-542.

Linderholm, H. (1967). Experience from training of conscripts. Forsvarmedicin, 3, 188-201.

Lott, G. G., and Gatchell, R. J. (1978). A multi-response analysis of learned heart rate control. Psychophysiology, 15(6), 576-581.

Lovallo, W. R. and Pishkin, V. (1980a). Type A behaviour, self-involvement, autonomic activity, and the traits of neuroticism and extroversion. Psychosomatic Medicine, 42(3), 329-334.

Lovallo, W. R. and Pishkin, V. (1980b). A psychophysiological comparison of Type A and Type B men exposed to failure and uncontrollable noise. Psychophysiology, 17(1), 29-36.

Luloffs, R., van Diest, R., and van Der Molen (1986). Differential reactions of Type A and Type B males to negative feedback about performance. Journal of Psychosomatic Research, 30(1), 35-40.

Lundberg, U., and Forsman, L. (1979). Adrenal-medullary and adrenal-corticol responses to understimulation and overstimulation: Comparison between Type A and Type B persons. Biological Psychology, 9, 79-89.

Luria, A. R., and Simernitskaya, E. G. (1977). Interhemispheric relations and the functions of the minor hemisphere. Neuropsychologia, 15, 175-178.

Lutz, D. J., Holmes, D. S., and Cromer, R. E. (1987). Hard-driving and speed impatience components of the Type A behaviour pattern as predictors of physiological arousal, subjective arousal and challenge seeking. Journal of Psychosomatic Research, 31(6), 713-722.

MacDougall, J. M., Dembroski, T. M., and Musante, L. (1979). The structured interview and questionnaire methods of assessing coronary-prone behavior in male and female college students. Journal of Behavioral Medicine, 2(1), 71-83.

Mackay, C J. (1980). The measurement of mood and psychophysiological activity using self-report techniques. In I. Martin and P. H. Venables (Eds.), Techniques in psychophysiology (pp. 501-562). Chichester: John Wiley and Sons.

Malcom, A. T., Janisse, M. P., and Dyck, D. G. (1984). Type A behaviour, heart rate and pupillary response: effects of cold pressor and ego threat. Journal of Psychosomatic Research, 28(1), 27-34.

Mandler, G., Mandler, J. M., and Uviller, E. T. (1958). Autonomic feedback: the perception of autonomic activity. Journal of Abnormal Social Psychology, 58, 367-373.

Mann, A. H., and Brennan, P. J. (1987). Type A behaviour score and the incidence of cardiovascular disease: A failure to replicate the claimed associations. Journal of Personality Research, 31(6), 685-692.

Manning, D. T., Balson, P. M., Hunter, S. M., Berenson, G. S., and Willis, A. S. (1987). Comparison of the prevalence of Type A behaviour in boys and girls from two contrasting socioeconomic status groups. Journal of Human Stress, 13(3), 116-120.

Manuck, S. B., Craft, S., and Gold, K. J. (1978). Coronary-prone behavior pattern and cardiovascular response. Psychophysiology, 15(5), 403-411.

Manuck, S. B., and Garland, F. N. (1979). Coronary-prone behavior pattern, task incentive, and cardiovascular response. Psychophysiology, 16(2), 136-142.

Margolis, L. H., McLeroy, K. R., Runyan, C. W., and Kaplan, B. H. (1983). Type A behavior: An ecological approach. Journal of Behavioral Medicine, 6(3), 245-258.

Matteson, M. T., and Ivancevich, J. M. (1980). The coronary-prone behaviour pattern: A review and appraisal. Social Science and Medicine, 14A, 337-351.

Matteson, M. T., and Ivancevich, J. M. (1982). Type A and Type B behaviour pattern and self-reported health symptoms and stress: Examining individual and organizational fit. Journal of Occupational Medicine, 24(8), 585-590.

Matthews, K. A. (1977). Caregiver-child interaction and the Type A coronary-prone behaviour pattern. Child Development, 48, 1752-1756.

Matthews, K. A. (1979). Efforts to control by children and adults with the Type A coronary-prone behavior pattern. Child Development, 50, 842-847.

Matthews, K. A. (1981). "At a relatively early age...The habit of working the machine to its maximum capacity": Antecedents of the Type A coronary-prone behavior pattern. In S. Brehm, S. M. Kassin, and F. X. Gibbons (Eds.), Developmental Social Psychology Theory and Research (pp. 235-248). New York: Oxford University Research.

Matthews, K. A. (1982). Psychological perspectives on the Type A behaviour pattern. Psychological Bulletin, 91(2), 293-323.

Matthews, K. A. and Angulo, J. (1980). Measurement of the Type A behavior pattern in children: Assessment of children's competitiveness, impatience, anger and aggression. Child Development, 51, 466-475.

Matthews, K. A. and Brunson, B. I. (1979). Allocation of attention and the Type A coronary-prone behaviour pattern. Journal of Personality and Social Psychology, 37(11), 2081-2090.

Matthews, K. A. , Glass, D. C., Rosenman, R. H., and Bortner, R. W. (1977). Competitive drive, Pattern A, and coronary heart disease: A further analysis of some data from the Western Collaborative Group Study. Journal of Chronic Diseases, 30, 489-498.

Matthews, K. A., and Haynes, S. G. (1986). Type A behavior pattern and coronary disease risk: Update and critical evaluation. American Journal of Epidemiology, 123(6), 923-960.

Matthews, K. A. and Krantz, D. S. (1976). Resemblance of twins and their parents in Pattern A behavior. Psychosomatic Medicine, 38, 140-144.

Matthews, K. A., Krantz, D. S., Dembroski, T. M., and MacDougall, J. M. (1982). Unique and common variance in Structured Interview and Jenkins Activity Survey measures of the Type A behaviour pattern. Journal of Personality and Social Psychology, 42(2), 303-313.

Matthews, K. A. and Saal, F. E. (1978). Relationship of the Type A coronary-prone behavior pattern to achievement, power and affiliation motives. Psychosomatic Medicine, 40, 631-636.

Matthews, K. A., and Siegel, J. M. (1983). Type A behaviours by children, social comparison, and standards for self-evaluation. Developmental Psychology, 19, 135-140.

Matthews, K. A., Siegel, J. M., Kuller, L. H., Thompson, M., and Varat, M. (1983). Determinants of decisions to seek medical treatment by patients with acute myocardial infarction symptoms. Journal of Personality and Social Psychology, 44(6), 1144-1156.

McClelland, D. C., Floor, E., Davidson, R. J., and Saron, C. (1980). Stressed power motivation, sympathetic activation, immune function and illness. Journal of Human Stress, 6, 11-19.

McFarland, R. A. (1975). Heart rate perception and heart rate control. Psychophysiology, 12, 402-405.

Mechanic, D. (1972). Social psychologic factors affecting the presentation of bodily complaints. The New England Journal of Medicine, 286(21), 1132-1139.

Mechanic, D. (1980). The experience and reporting of common physical complaints. Journal of Health and Social Behaviour, 21, 146-55.

Menninger, K. A., and Menninger, W. C. (1936). Psychoanalytic observations in cardiac disorders. American Heart Journal, 11, 10-21.

Mettlin, C. (1976). Occupational careers and their prevention of coronary-prone behavior. Social Science and Medicine, 10, 367-372.

Miller, G., Galanter, E., and Pribram, K. (1960). Plans and the structure of behavior. New York: Holt.

Milller, L., and Cox, C. (1980). Unpublished manuscript, University of Texas, 1980.

Miller, L. C., Murphy, R., and Buss, A. (1981). Consciousness of body: Private and public. Journal of Personality and Social Psychology, 41(2), 397-406.

Miller, S. M., Lack, E. R., and Asroff, S. (1985). Preference for control and the coronary-prone behaviour pattern: "I'd rather do it myself". Journal of Personality and Social Psychology, 49(2), 492-499.

Moos, R. (1975). Evaluating correctional and community settings. New York: Wiley and Sons.

Moos, R., and Van Dort, B. (1977). Physical and emotional symptoms and campus health center utilization. Social Psychiatry, 12, 107-115.

Morris, J. N., Marr, J. W., Heady, J. A., Mills, G. L., and Pilkington, T. R. E. (1963). Diet and plasma cholesterol in 99 bank men. British Medical Journal, 1, 571-576.

Mueser, K. T., Yarnold, P. R., and Bryant, F. B. (1987). Type A behaviour and time urgency: Perception of time adjectives. British Journal of Medical Psychology, 60, 267-269.

Myrtek, M., and Greenlee, M. W. (1984). Psychophysiology of Type A behaviour pattern: Activity analysis. Journal of Psychosomatic Research, 28(6), 455-466.

Navon, D., and Gopher, D. (1979). On the economy of the human-processing system. Psychological Review, 86, 214-255.

Nielson, W. R., and Neufeld, R. W. J. (1986). Utility of the uncontrollability construct in relation to the Type A behaviour pattern: A multidimensional investigation. Canadian Journal of Behavioural Science, 18(3), 224-237.

Norman, D. A. (1968). Toward a theory of memory and attention. Psychological Review, 75, 522-536.

Nunes, E. V., Frank, K. A., and Kornfeld, D. S. (1987). Psychologic treatment for the Type A behaviour pattern and for coronary heart disease: A meta-analysis of the literature. Psychosomatic Medicine, 48(2), 159-173.

Orth-Gomer, K., and Ahlblom, A. (1980). Impact of psychological stress on ischemic heart disease when controlling for conventional risk factors. Journal of Human Stress, 6, 7-15.

Osler, W. (1910). The Lumlian lectures on angina pectoris. Lancet, I, 839-844.

Paul, O., Lepper, M. H., Phelan, W. F., Dupertius, G. W., MacMillan, A., McKean, H., and Park, H. (1963). A longitudinal study of coronary heart disease. Circulation, 28, 20-31.

Pearson, T. A., (1983). Risk factors for arteriographically defined coronary artery disease. Doctoral Dissertation from the Johns Hopkins University. #83-16989. Ann Arbor, MI: University Microfilms International.

Pennebaker, J. W. (1980). Perceptual and environmental determinants of coughing. Basic and Applied Social Psychology, 1, 83-91.

Pennebaker, J. W. (1982). The psychology of physical symptoms. New York: Springer-Verlag.

Pennebaker, J. W. (1983). Physical symptoms and sensations: Psychological causes and correlates. In J. T. Cacioppo and R. E. Petty (Eds.), Social psychophysiology: A sourcebook (pp. 543-564). New York: The Guilford Press.

Pennebaker, J. W., and Brittingham, G. L. (1979). Situational and attentional factors influencing health: Person-environment fit. Paper presented at the American Physiological Association, New York.

Pennebaker, J. W., Burnam, M. A., Schaeffer, M. A., and Harper, D. C. (1977). Lack of control as a determinant of perceived physical symptoms. Journal of Personality and Social Psychology, 35(3), 167-174.

Pennebaker, J. W., Gonder-Frederick, L., Stewart, H., Elfman, L., and Skelton, J. A. (1982). Physical symptoms associated with blood pressure. Psychophysiology, 19(2), 201-210.

Pennebaker, J. W., and Lightner, J. M. (1980). Competition of internal and external information in the exercise setting. Journal of Personality and Social Psychology, 39(1), 165-174.

Perosio, A. M., Capris, T. A., Moores, A. J. F., Iraola, L., and Rossi, S. (1977). Evolucion de la enfermedad coronaria cronica. La Prensa Medica Argentina, 64, 27-32.

Pickering, T. C. (1986). Should studies of patients undergoing coronary angiography be used to evaluate the role of behavioral risk factors for coronary heart disease. Journal of Behavioral Medicine, 28, 203-213.

Pittner, M. S. and Houston, B. K. (1980). Responses to stress: Cognitive coping strategies and the Type A behaviour pattern. Journal of Personality and Social Psychology, 39(1), 147-157.

Pittner, M. S., Houston, B. K., and Spiridigliozzi, G. (1983). Control over stress, Type A behaviour pattern and responses to stress. Journal of Personality and Social Psychology, 44(3), 627-637.

Powers, W. T. (1973). Behaviour: The control of perception. Chicago: Aldine.

Price, K. P. (1979). Reliability of assessment of coronary-prone behavior with special reference to the Bortner rating scale. Journal of Psychosomatic Research, 23, 45-47.

Price, K. P., and Clarke, C. K. (1978). Behavioral and psychophysiological correlates of the coronary-prone personality: New data and unanswered questions. Journal of Psychosomatic Research, 22, 409-417.

Price, V. A. (1982). Type A Behavior Pattern: A model for research and practice. New York: Academic Press.

Rahe, R. H., Hervig, L., and Rosenman, R. H. (1978). Heritability of Type A behavior. Psychosomatic Medicine, 40, 478-486.

Rahe, R. H., Romo, M., Bennet, L., and Siltanen, P. (1974). Recent life changes, myocardial infarction, and abrupt coronary death. Archives of Internal Medicine, 133, 221-228.

Rauste-von Wright, M., von Wright, J., and Frankenhauser, M. (1981). Relationships between sex-related psychological characteristics during adolescence and catecholamine excretion during achievement stress. Psychophysiology, 18, 362-370.

Raven, J. C. (1962). Advanced Progressive Matrices - Set II. London: H. K. Lewis and Company.

The Review Panel on Coronary-prone Behaviour and Coronary Heart Disease (1981). Coronary-prone behaviour and coronary heart disease: A critical review. Circulation, 63(6), 1199-1215.

Rhodewalt, F., and Agustdottir, S. (1984). On the relationship of hardiness to the Type A behaviour pattern. Perception of life events versus coping with life events. Journal of Research in Personality, 18, 212-223.

Rhodewalt, F., and Comer, R. (1982). Coronary-prone behavior and reactance: The attractiveness of an eliminated choice. Personality and Social Psychology Bulletin, 8, 152-158.

Richter, C. P. (1957). On the phenomenon of sudden death in animals and man. Psychosomatic Medicine, 19, 191-198.

Rodahl, K. and Issekutz, B. (1962). Physical performance capacity of the older individual. In K. Rodahl and S. M. Horvath (Eds.), Muscle as a tissue. New York: McGraw-Hill Book Company.

Rosell, S., and Belfrage, E. (1975). Adrenergic receptors in the adipose tissue and their relation to adrenergic innervation. Nature, 253, 738-739.

Rosenman, R. H. (1974). The role of behavior patterns and neurogenic factors in the pathogenesis of coronary heart disease. In R. S. Eliot (Ed.), Stress and the heart, (pp. 123-141). New York: Futura Publishing .

Rosenman, R. H. (1978). The interview method of assessment of the coronary-prone behavior pattern. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 55-70). New York: Springer-Verlag.

Rosenman, R. H. (1983). Current and past history of Type A behaviour pattern. In T. H. Schmidt, T. M. Dembroski, and G. Blumchen (Eds.), Biological and physiological factors in cardiovascular disease (pp. 15-40). New York: Springer-Verlag.

Rosenman, R. H. (1986). Current and past history of Type A behaviour pattern. In T. H. Schmidt, T. M. Dembroski, and G. Blumchen (Eds.), Biological and psychological factors in cardiovascular disease (pp. 15-40). New York: Springer-Verlag.

Rosenman, R. H., Brand, R. J., Jenkins, C. D., Friedman, M, Strauss, R., and Wurm, M. (1975). Coronary heart disease in the Western Collaborative Group Study: Final follow-up experience of 8.5 years. Journal of the American Medical Association, 233, 872-877.

Rosenman, R. H., and Friedman, M. (1959). The possible relationship of the emotions to clinical coronary heart disease. In G. Pincus (Ed.), Hormones and Atherosclerosis (pp. 283-300). New York: Academic Press.

Rosenman, R. H., and Friedman, M. (1961). Association of specific behavior pattern in women with blood and cardiovascular findings. Journal of the American Medical Association, 24, 1173-1184.

Rosenman, R. H., and Friedman, M. (1977). Modifying the Type A behavior pattern. Journal of Psychosomatic Research, 21, 323-331.

Rosenman, R. H., Friedman, M., Strauss, R., Jenkins, C. D., Zyzanski, S. J., and Wurm, M. (1970). Coronary heart disease in the Western Collaborative Group Study: A follow-up experience of four and a half years. Journal of Chronic Diseases, 23, 173-190.

Rosenman, R. H., Friedman, M., Strauss, R., Wurm, M., Jenkins, C. D., and Messinger, H. B. (1966). Coronary heart disease in the Western Collaborative Group Study: a follow-up exercise of two years. Journal of the American Medical Association, 195, 86-92.

Rosenman, R. H., Friedman, M., Strauss, R., Wurm, M., Kositchek, R., Hahn, W., and Werthessen, N. T. (1964). A predictive study of coronary heart disease. Journal of the American Medical Association, 189, 103-110.

Rosenman, R. H., Rahe, R. H., Borhani, N. O., and Feinleib, M. (1976). Heritability of personality and behavior pattern. Acta Geneticae Medicae et Gemellologiae, 25, 221-224.

Ross, A., and Brener, J. (1981). Two procedures for training cardiac discrimination: A comparison of solution strategies and their relationship to heart rate control. Psychophysiology, 18, 62-70.

Ross, R., and Glomset, J. A. (1976). The pathogenesis of atherosclerosis, Part 1. New England Journal of Medicine, 295, 369-420.

Rustin, R. M., Dramaix, M., Kittel, F., Degre, C, Kornitzer, M, Thilly, C., and De Backer, G. (1976). Validation de techniques d'evaluation de profil comportemental 'A' utilisees dans le 'Projet Belge de Prevention des addections cardiovasculaires' (PBP). Revue d' Epidemiologie, Medicine Sociale et Sante Publique, 24, 497-507.

Sadler, O., and Tesser, A. (1973). Some effects of salience and time upon interpersonal hostility and attraction during social isolation. Sociometry, 36, 99-112.

Sandman, C. A. (1986). Cardiac afferent influences on consciousness. In R. J. Davidson, J. Schwartz, and D. Shapiro (Eds.), Consciousness and self-regulation: Advances in research and theory, Volume 4 (pp. 55-85). New York: Plenum Press.

Schachter, S., and Singer, J. E. (1962). Cognitive, social, and physiological determinants of emotional state. Psychological Review, 69(5), 379-399.

Schandry, R. (1981). Heart beat perception and emotional experience. Psychophysiology, 18(4), 483-488.

Scheier, M. F. (1976). Self-awareness, self-consciousness and angry aggression. Journal of Personality, 44, 627-644.

Scheier, M. F., Buss, A. H., and Buss, D. M. (1978). Self-consciousness, self-report of aggressiveness, and aggression. Journal of Research in Personality, 12, 133-140.

Scheier, M. F., and Carver, C. S. (1977). Self-focused attention and the experience of emotion: attraction, repulsion, elation, and depression. Journal of Personality and Social Psychology, 35(9), 625-636.

Scheier, M. F., Carver, C. S., and Gibbons, F. X. (1979). Self-directed attention, awareness of bodily states, and suggestibility. Journal of Personality and Social Psychology, 37, 1576-1588.

Scheier, M. F., Carver, C. S., and Matthews, K. A. (1983). Attentional factors in the perception of bodily states. In J. T. Cacioppo and R. E. Petty (Eds.), Social Psychophysiology (pp. 510-542). New York: The Guilford Press.

Scherwitz, L., Berton, R., and Leventhal, H. (1977). Type A assessment and interaction in the behaviour pattern interview. Psychosomatic Medicine, 39, 229-240.

Scherwitz, L., Berton, R., and Leventhal, H. (1978). Type A behaviour, self-involvement, and cardiovascular response. Psychosomatic Medicine, 40(8), 593-609.

Scherwitz, L., Graham, L. E., Grandits, G., and Billings, J. (1987). Speech characteristics and behaviour-type assessment in the Multiple Risk Factor Intervention Trial (MRFIT) structured interviews. Journal of Behavioral Medicine, 10(2), 173-195.

Scherwitz, L., McKelvain, R., Laman, C., Patterson, J., Dutton, L., Yusin, S., Lester, J., Kraft, I., Rochelle, D., and Leachman, R. (1983). Type A behavior, self-involvement, and coronary atherosclerosis. Psychosomatic Medicine, 45, 47-57.

Schlegel, R. P., Wellwood, J. K., Copps, B. E., Gruchow, W. H., and Sharratt, M. T. (1980). The relationship between perceived challenge and daily symptom reporting in Type A vs. Type B post infarct subjects. Journal of Behavioral Medicine, 3(2), 191-204.

Schroder, D. H., and Costa, R. T. (1984). Influence of life event stress on physical illness. Substantive effects or methodological flaws. Journal of Personality and Social Psychology, 46, 853-863.

Schwartz, G. E. (1983). Disregulation theory and disease: Applications to the repression/cerebral disconnection/cardiovascular disorder hypothesis. Special issue on behavioral medicine. International Review of Applied Psychology, 32, 95-118.

Seligman, M. E. P. (1975). Helplessness: On depression, development and death. San Francisco: Freeman.

Shaper, A. G. (1962). Cardiovascular studies in the Samburu tribe of northern Kenya. American Heart Journal, 63, 437-442.

Shekelle, R. B., Gayle, M., Obstfeld, A., and Ogelsby, P. (1983). Hostility, risk of coronary heart disease and mortality. Psychosomatic Medicine, 45, 109-114.

Shekelle, R. B., Hulley, S. B., Neaton, J. D., Billings, J. H., Borhani, N. O., Gerace, T. A., Jacobs, D. R., Lasser, N. L., Mittlemark, M. B., and Stammler, J. (for the Multiple Risk Factor Intervention Trial Research Group) (1985). The MRFIT behavior pattern study. American Journal of Epidemiology, 122(4), 559-570.

Shekelle, R. B., Schoenberger, J. A., and Stamler, J. (1976). Correlates of the JAS Type A behaviour pattern score. Journal of Chronic Diseases, 29, 381-394.

Shucker, B., and Jacobs, D. R. (1977). Assessment of behavioral risk for coronary disease by voice characteristics. Psychosomatic Medicine, 39, 219-228.

Siegel, J. M. (1984). Type A behavior: Epidemiologic foundations and public health implications. Annual Review of Public Health, 5, 343-367.

Siegel, J. M., and Leitch, C. J. (1981). Assessment of the Type A behavior pattern in adolescents. Psychosomatic Medicine, 43(1), 45-56.

Siegel, J. M., Matthews, K. A., and Leitch, C. J. (1981). Validation of the Type A interview assessment of adolescents: A multidimensional approach. Psychosomatic Medicine, 43(4), 311-321.

Silver, L., Jenkins, C. D., Ryan, T. J., and Melidossian, C. (1980). Sex differences in psychological correlates of cardiovascular diagnosis and coronary angiographic findings. Journal of Psychosomatic Research, 24, 327-334.

Simpson, M. T., Olewine, D. A., Jenkins, C. D., Ramsey, F. H., Zyzanski, S. J., Thomas, G., and Hames, C. G. (1974). Exercise induced catecholamines and platelet aggregation in the type A coronary-prone behavior pattern. Psychosomatic Medicine, 36, 476-487.

Skinner, J. S., Borg, G., and Buskirk, E. R. (1969). Physiological and perceptual characteristics of young men in activity and body composition. In B. D. Franke (Ed.), Exercise and Fitness. (Proceedings of a symposium presented in Champaign-Urbana Campus, April 25-26).

Smith, T. W., and Brehm, S. S. (1981). Person perception and the Type A coronary-prone behaviour pattern. Journal of Personality and Social Psychology, 40(6), 1137-1149.

Snow, B. (1978). Level of aspiration in coronary-prone and noncoronary-prone adults. Personality and Social Psychology Bulletin, 4, 416-419.

Snyder, M. L., and Frankel, A. (1975). Reactance and the Type A. Unpublished manuscript. Dartmouth College.

Spielberger, C. D., Gorsuch, R. L., and Lushene, R. (1970). State-Trait Anxiety Inventory. Palo Alto, California: Consulting Psychologists Press.

Spjøtvoll, E., and Stoline, M. R. (1973). An extension of the *T*-method of multiple comparisons to include the cases with unequal sample size. Journal of the American Statistical Association, 68, 975-978.

SPSS Inc. (1983). SPSS^X User's Guide: A complete guide to SPSS^X language and operation. New York: McGraw-Hill.

Steptoe, A., and Ross, A. (1981). Psychophysiological reactivity and the prediction of cardiovascular disorders. Journal of Psychosomatic Research, 25, 23-31.

Stern G. S., and Elder, R. D. (1982). The role of challenging incentives in feedback - assisted heart rate reduction for coronary-prone adult males. Biofeedback and Self-Regulation, 7(1), 53-69.

Stern G. S., Harris, J. R., and Elverum, J. (1981). Attention to important versus trivial tasks and salience of fatigue-related symptoms for coronary prone individuals. Journal of Research in Personality, 15, 467-474.

Stevens, J. H., Turner, C. W., Rhodewalt, F., and Talbot, S. (1984). The Type A behaviour pattern and carotid artery atherosclerosis. Psychosomatic Medicine, 46, 105-113.

Stokols, J.J. (1973). Life dissatisfaction as a risk factor in coronary heart disease. Unpublished Doctoral Dissertation, University of North Carolina.

Stout, C. W., and Bloom, L. J. (1982). Type A behaviour and upper respiratory infections. Journal of Human Stress, 8, 4-7.

Strahan, R. F. (1981). Time urgency, Type A behavior and effect strength. Journal of Consulting and Clinical Psychology, 49, 134.

Stroop, J. R. (1935). Studies on interference in serial verbal reactions. Journal of Experimental Psychology, 18, 643-662.

Strube, M. J. (1985). Attributional style and the Type A coronary-prone behaviour pattern. Journal of Personality and Social Psychology, 49(2), 500-509.

Strube, M. J. (1987). A self-appraisal model of the Type A behavior pattern. In R. Hogan, and W. H. Jones (Eds.) Perspectives in personality: Theory, measurement and interpersonal dynamics. Greenwich, CT: JAI Press.

Strube, M. J., Berry, J. M., and Moergen, S. (1985). Relinquishment of control and the Type A behaviour pattern: The role of performance evaluation. Journal of Personality and Social Psychology, 49(3), 831-842.

Strube, M. J., and Boland, S. M. (1986). Postperformance attributions and task persistence among Type A and B individuals: A Clarification. Journal of Personality and Social Psychology, 50(2), 413-420.

Strube, M. J., Boland, S. M., Manfredo, P. A., Al-Falaij, A. (1987). Type A behavior pattern and the self-evaluation of abilities: Empirical tests of the self-appraisal model. Journal of Personality and Social Psychology, 52(5), 956-974.

Strube, M. J., Turner, C. W., Patrick, S., and Perrillo, R. (1983). Type A and Type B attentional responses to aesthetic stimulus: Effects on mood and performance. Journal of Personality and Social Psychology, 45(6), 1369-1379.

Strube, M. J., Turner, C. W. , Cerro, D., Stevens, J., and Hinchey, F. (1984). Interpersonal aggression and the Type A coronary-prone behavior pattern: A theoretical distinction and practical implications. Journal of Personality and Social Psychology, 47, 839-847.

Strube, M. J., and Werner, C. (1985) . Relinquishment of control and the Type A behavior pattern. Journal of Personality and Social Psychology, 48, 688-701.

Suinn, R. U. (1978). The coronary-prone behavior pattern: a behavioral approach to intervention. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 231-236). New York: Springer-Verlag.

Suls, S., Becker, M. A., and Mullen, B. (1981). Coronary-prone behaviour, social insecurity and stress among college-aged adults. Journal of Human Stress, 7, 27-34.

Suls, S., and Fletcher, B. (1985) Self-attention, life stress, and illness: A prospective study. Psychosomatic Medicine, 45(5), 469-481.

Suls, S., Gastorf, J. W., and Witenberg, S. H. (1979). Life events, psychological distress and the Type A coronary-prone behaviour pattern. Journal of Psychosomatic Research, 23, 315-319.

Surwitt, R. S., Williams, R. B., and Shapiro, D. (1982). Behavioral approaches to cardiovascular disease. New York: Academic Press.

Swan, G. E., Chesney, M. E., Black, G. W., Ward, M. M., and Rosenman, R. H. (1986). Self-reported somatic symptoms in Type A and Type B middle-aged males. Stress Medicine, 2, 63-68.

Tennant, C., and Andrews, J. G. (1978). The cause of life events in neurosis. Journal of Psychosomatic Research, 22, 41-45.

The MRFIT behavior pattern study (1979). I. Study design, procedures, and reproducibility of behaviour pattern judgements. Journal of Chronic Diseases, 32, 293-305.

The MRFIT Study Group (1982). Multiple Risk Factor Intervention Trial: risk factor changes and mortality results. Journal of the American Medical Association, 248, 1465-1477.

Theorell, T. (1974). Life events before and after the onset of premature myocardial infarction. In B. S. Dohrenwend and B. P. Dohrenwend (Eds.), Stressful life events: Their nature and effects (pp. 101-117). New York: Wiley and Sons.

Theorell, T., and Rahe, R. H. (1972). Behavior and life satisfaction characteristics of Swedish subjects with myocardial infarction. Journal of Chronic Diseases, 25, 139-147.

Theorell, T., and Rahe, R. H. (1975). Life change events, ballistocardiography and coronary death. Journal of Human Stress, 3, 18-25.

Thurstone, L. (1953). Thurstone Temperament Schedule. Chicago: Science Research Associates.

Treisman, A. M. (1969). Strategies and models of selective attention. Psychological Review, 76, 282-299.

Tukey, J. W. (1953). The problem of multiple comparisons. Princeton University Press.

Turner, R. G., Scheier, M. F., Carver, C. S., and Ickes, W. (1978). Correlates of self-consciousness. Journal of Personality Assessment, 42(3), 285-289.

United States National Center for Health Statistics (1979). Use habits among adults of cigarettes, coffee, aspirin, and sleeping pills. Series 10, Numer 131. Washington D.C.: United States Government Printing Office.

Van Egeren, L. F. (1979a). Social interactions, communications and the coronary-prone behaviour pattern: a psychophysiological study. Psychosomatic Medicine, 41(1), 2-18.

Van Egeren, L. F. (1979b). Cardiovascular changes during social competition in mixed-motive games. Journal of Personality and Social Psychology, 37, 858-864.

Van Egeren, L. F. , Abelson, J. L., and Sniderman, C. D. (1983). Interpersonal and electrocardiographic responses of Type A's and Type B's in competitive socioeconomic games. Journal of Psychosomatic Research, 27(1), 53-59.

Van Schijndel, M., De May, H., and Naring, G. (1984). Effects of behavioral control and Type A behavior on cardiovascular response. Psychophysiology, 21, 501-509.

Vickers, R. A. (1973). A short measure of the Type A personality. Unpublished manuscript, University of Michigan, Institute of Social Research.

Von Bertalanffy, L. (1968). General systems theory. New York: Braziller.

Waldron, I. (1978). Sex differences in the coronary-prone behavior pattern. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 199-206). New York: Springer-Verlag.

Waldron, I., Hickey, A., McPherson, C., Butensky, A., Gross, L., Overall, K., Schmader, A., and Wohlmuth, D. (1980). Type A behaviour pattern: Relationship to variation in blood pressure, parental characteristics, and academic and social activity of students. Journal of Human Stress, 6, 16-27.

Waldron, I., Zyzanski, S., Shekelle, R., Jenkins, C. D., and Tannenbaum, S (1977). The coronary-prone behavior pattern in employed men and women. Journal of Human Stress, 3, 2-18.

Walker, B. B., and Sandman, C. A. (1979). Human visual evoked responses are related to heart rate. Journal of Comparative and Physiological Psychology, 93, 717-729.

Walker, B. B., and Sandman, C. A. (1982). Visual evoked potentials change as heart rate and carotid pressure change. Psychophysiology, 19, 520-527.

Ward, C. H. and Eisler, R. M. (1987). Type A behaviour, achievement striving, and a dysfunctional self-evaluation system. Journal of Personality and Social Psychology, 53(2), 318-326.

Wardell, W. I., and Behnson, C. B. (1973). Behavioral variables and myocardial infarction in the Southeastern Connecticut heart study. Journal of Chronic Diseases, 26, 447-448.

Wechsler, D. (1955). Manual for the Weschler Adult Intelligence Scale. New York: Psychological Corporation.

Weidner, G. (1980). Self-handicapping following learned helplessness treatment and the Type A coronary-prone behaviour pattern. Journal of Psychosomatic Research, 24, 319-325.

Weidner, G., and Matthews, K. A. (1978). Reported physical symptoms elicited by unpredictable events and the Type A coronary-prone behaviour pattern. Journal of Personality and Social Psychology, 36(11), 1213-1220.

Weidner, G., Sexton, G., McLelland, R., Connor, S. L., and Matarazzo, J. D. (1987). The role of Type A behaviour and hostility in an elevation of plasma lipids in adult women and men. Psychosomatic Medicine, 49(2), 136-145.

Weiman, C. (1977). A study of occupational stressor and the incidence of disease/risk. Journal of Occupational Medicine, 19, 119-122.

Whitehead, W. E., Drescher, V. M., Heiman, P., and Blackwell, B. (1977). Relation of heart rate control to heartbeat perception. Biofeedback and Self-Regulation, 2, 371-392.

Wicklund, R. A. (1975). Objective self-awareness. In L. Berkowitz (Ed.), Advances in Experimental Social Psychology, Volume 7, (pp. 319-342). New York: Academic Press.

Williams, R. B. (1978). Psychophysiological processes, the coronary-prone behavior pattern, and coronary heart disease. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 141-146). New York: Springer-Verlag.

Williams, R. B., Barefoot, J. C., Hanley, T. L., Harrell, F. E., Blumenthal, J. A., Pryor, D. B., and Peterson, B. (1986). Type A behavior and angiographically documented coronary atherosclerosis in a sample of 2,289 patients. Paper presented at the American Psychosomatic Society meetings, Baltimore, MD, USA.

Williams, R. B., Bittner, T. E., Buschbaum, M. S., and Wynne, L. C. (1975). Cardiovascular and neurophysiological correlates of sensory intake and rejection. One: Effect of cognitive tasks. Psychophysiology, 12, 427-433.

Williams, R. B., Friedman, M., Glass, D. C., Herd, I. A., and Schneiderman, N. (1978). Section III summary: Mechanisms linking behavioral and pathophysiological processes. In T. M. Dembroski, S. M. Weiss, J. L. Shields, S. G. Haynes and M. Feinleib (Eds.), Coronary-prone behavior (pp. 119-128). New York: Springer-Verlag.

Williams, R. B. , Haney, T. L., Lee, K. L., Kong, Y. H., Blumenthal, J. A., and Whalen, R. E. (1980). Type A behaviour, hostility, and coronary atherosclerosis. Psychosomatic Medicine, 42(6), 539-549.

Wilmore, J. H., and Behnke, A. R. (1969). An anthropometric estimation of body density and lean body weight in young men. Journal of Applied Physiology, 27(1), 25-31.

Wolf, T., Sklov, M., Wenzl, P., Hunter, S., and Berenson, G. (1982). Validation of a measure of Type A behaviour pattern in children: Bogolusa Heart Study. Child Development, 53, 126-135.

Wright, D., Kane, R., Olsen, D., and Smith, T. (1977). The effects of selected psychosocial factors on the self-reporting of pulmonary symptoms. Journal of Chronic Diseases, 30, 195-206.

Yarnold, P. R., and Grimm, L. G. (1982). Time urgency among coronary-prone individuals. Journal of Abnormal Psychology, 91, 175-177.

Yarnold, P. R., and Mueser, K. T. (1984). Time urgency of Type A individuals: Two replications. Perceptual and Motor Skills, 59, 334.

Yarnold, P. R., Mueser, K. T., and Lyons, J. S. (1987). Accountability and the work rate of Type As. Paper presented at the Annual Meeting of the Association for the Advancement of Science. Chicago, U.S.A.

Yudkin, J. (1957). Diet and coronary thrombosis, hypothesis and fact. Lancet, II, 155-162.

Yuhasz, M. S. (1962). The effects of sports training on body fat in men with prediction of optimal body weight. Unpublished Doctoral Dissertation. Urbana, Ill. : University of Illinois.

Zyzanski, S. J., and Jenkins, C. D. (1970). Basic dimensions within the coronary-prone behaviour pattern. Journal of Chronic Diseases, 22, 781-795.

Zyzanski, S. J., Jenkins, C. D., Ryan, T. J., Flessas, A., and Everist, M. (1976). Psychological correlates of coronary angiographic findings. Archives of International Medicine, 136, 1234-1237.

Zyzanski, S. J., Wrzesniewski, K., and Jenkins, C. D. (1979). Cross-cultural validation of the coronary-prone behavior pattern. Social Science and Medicine, 13A, 405-412.

APPENDICES

APPENDIX A

A.1 **Studies 1 to 6**

Jenkins Activity Survey - Form C (Jenkins et al., 1979)

Personal Activity Questionnaire

This asks questions about aspects of behaviour that have been found helpful in medical diagnosis. Each person is different, so there are no 'right' or 'wrong' answers. For each question, choose the answer that is true for you, and fill in the space in front of that answer. Mark only one answer for each question.

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1. Do you ever have trouble finding time to get your hair cut or styled?
   A. [ ] Never
   B. [ ] Occasionally
   C. [ ] Almost always

2. How often does your job 'stir you into action'?
   A. [ ] Less often than most people's jobs
   B. [ ] About average
   C. [ ] More than most people's jobs

3. Is your everyday life filled mostly by
   A. [ ] problems needing a solution?
   B. [ ] challenges needing to be met?
   C. [ ] a rather predictable routine of events?
   D. [ ] not enough things to keep me interested or busy?

4. Some people live in a calm predictable life. Others find themselves facing unexpected changes, frequent interruptions, inconveniences, or 'things going wrong'. How often are you faced with these minor (or major) annoyances or frustrations?
   A. [ ] Several times a day
   B. [ ] About once a day
   C. [ ] A few times a week
   D. [ ] Once a week
   E. [ ] Once a month or less

5. When you are under pressure or stress, what do you usually do?
   A. [ ] Do something about it immediately
   B. [ ] Plan carefully before taking any action

6. Ordinarily, how rapidly do you eat?
   A. [ ] I'm usually the first one finished
   B. [ ] I eat a little faster than average
   C. [ ] I eat at about the same speed as most people
   D. [ ] I eat more slowly than most people

7. Has your spouse or a friend ever told you that you eat too fast?
   A. [ ] Yes, often
   B. [ ] Yes, once or twice
   C. [ ] No, never

8. How often do you find yourself doing more than one thing at a time, such as working while eating, reading while dressing, or figuring out problems while driving?
   A. [ ] I do two things at once whenever practical
   B. [ ] I do this only when I'm short of time
   C. [ ] I rarely or never do more than one thing at a time

9. When you listen to someone talking, and this person <u>takes too long</u> to come to the point, how often do you <u>feel</u> like hurrying the person along?
   A. [ ] Frequently
   B. [ ] Occasionally
   C. [ ] Almost never

10. How often do you actually 'put words in the person's mouth' in order to speed things up?
   A. [ ] Frequently
   B. [ ] Occasionally
   C. [ ] Almost never

11. If you tell your spouse or a friend that you will meet somewhere at a definite time, how often do you arrive late?
   A. [ ] Once in a while
   B. [ ] Rarely
   C. [ ] I am never late

12. How often do you find yourself hurrying to get places even when there is plenty of time?
   A. [ ] Frequently
   B. [ ] Occasionally
   C. [ ] Almost never

13. Suppose you are to meet someone at a public place (street corner, building lobby, restaurant) and the other person is already 10 minutes late. What will you do?
    A. [ ] Sit and wait
    B. [ ] Walk about while waiting
    C. [ ] Usually carry some reading matter or writing paper so I can get something done while waiting

14. When you have to 'wait in line' at a restaurant, a store, or the post office, what do you do?
    A. [ ] Accept it calmly
    B. [ ] Feel impatient but not show it
    C. [ ] Feel so impatient that someone watching can tell I am restless
    D [ ] Refuse to,wait in line, and find ways to avoid such delays

15. When you play games with young children about 10 years old (or when you did so in past years), how often do you purposefully let then win?
    A. [ ] Most of the time
    C. [ ] Half the time
    D. [ ] Only occasionally
    E. [ ] Never

16. When you were younger, did most people consider you to be
    A. [ ] definitely hard-driving and competitive?
    B. [ ] probably hard-driving and competitive?
    C. [ ] probably more relaxed and easygoing?
    D. [ ] definitely more relaxed and easygoing?

17. Nowadays, do you consider yourself to be
    A. [ ] definitely hard-driving and competitive?
    B. [ ] probably hard-driving and competitive?
    C. [ ] probably more relaxed and easygoing?
    D. [ ] definitely more relaxed and easygoing?

18. Would your spouse (or closest friend) rate your general level of activity as
    A. [ ] definitely hard-driving and competitive?
    B. [ ] probably hard-driving and competitive?
    C. [ ] probably relaxed and easygoing?
    D. [ ] definitely relaxed and easygoing?

19. Would your spouse (or closest friend) rate your general level of activity as

A. [ ] too slow-should be more active

B. [ ] about average-busy much of the time

C. [ ] too active-should slow down

20. Would people you know well agree that you take your work too seriously?

A. [ ] Definitely yes

B. [ ] Probably yes

C. [ ] Probably no

D. [ ] Definitely no

21. Would people you know well agree that you have less energy than most people?

A. [ ] Definitely yes

B. [ ] Probably yes

C. [ ] Probably no

D. [ ] Definitely no

22. Would people you know well agree that you tend to get irritated very easily?

A. [ ] Definitely yes

B. [ ] Probably yes

C. [ ] Probably no

D. [ ] Definitely no

23. Would people you know well agree that you tend to do most things in a hurry?

A. [ ] Definitely yes

B. [ ] Probably yes

C. [ ] Probably no

D. [ ] Definitely no

24. Would people you know well agree that you enjoy a 'contest' (competition) and try hard to win?

A. [ ] Definitely yes

B. [ ] Probably yes

C. [ ] Probably no

D. [ ] Definitely no

25. How was your temper when you were younger?
    - A. [ ] Fiery and hard to control
    - B. [ ] Strong but controllable
    - C. [ ] No problem
    - D. [ ] I almost never got angry

26. How is your tempter nowadays?
    - A. [ ] Fiery and hard to control
    - B. [ ] Strong but controllable
    - C. [ ] No problem
    - D. [ ] I almost never get angry

27. When you are in the midst of doing a job and someone (not your boss) interrupts you, how do you usually feel inside?
    - A. [ ] I feel O.K. because I work better after an occasional break
    - B. [ ] I feel only mildly annoyed
    - C. [ ] I really feel irritated because most such interruptions are unnecessary

28. How often are there deadlines in your job?
    - A. [ ] Daily or more often
    - B. [ ] Weekly
    - C. [ ] Monthly or less often
    - D. [ ] Never

29. These deadlines usually carry
    - A. [ ] minor pressure because of their routine nature
    - B. [ ] considerable pressure, since delay would upset my entire work group
    - C. [ ] deadlines never occur in my job

30. Do you ever set deadlines or quotas for yourself at work or at home?
    - A. [ ] No
    - B. [ ] Yes, but only occasionally
    - C. [ ] Yes, once a week or more

31. When you have to work against a deadline, what is the quality of your work?
    - A. [ ] Better
    - B. [ ] Worse
    - C. [ ] The same (pressure makes no difference)

32. At work, do you ever keep two jobs moving forward at the same time by shifting back and forth rapidly from one to the other?

A. [ ] No, never

B. [ ] Yes, but only in emergencies

C. [ ] Yes, regularly

33. Are you content to remain at your present job level for the next five years?

A. [ ] Yes

B. [ ] No, I want to advance

C. [ ] Definitely no; I strive to advance and will be dissatisfied if not promoted in that length of time

34. If you had your choice, which would you rather get?

A. [ ] A small increase in pay <u>without</u> a promotion to a higher level job

B. [ ] A promotion to a higher level job <u>without</u> an increase in pay

35. In the past three years, have you ever taken less than your allotted umber of leave days?

A. [ ] Yes

B. [ ] No

36. In the last three years, how has your personal yearly income changed?

A. [ ] It has remained the same or gone down

B. [ ] It has gone up slightly (as the result of 'cost of living' increases or automatic raises based on years of service)

C. [ ] It has gone up considerably

37. How often do you bring your work home with you at night, or study materials related to your job?

A. [ ] Rarely or never

B. [ ] Once a week or less

C. [ ] More than once a week

38. How often do you go to your place of work when you are not expected to be there (such as nights or weekends)?

A. [ ] It is not possible in my job

B. [ ] Rarely or never

C. [ ] Occasionally (less than once a week)

D. [ ] Once a week or more

39. When you find yourself getting tired on the job, what do you usually do?
    A. [ ] Slow down for a while until my strength comes back
    B. [ ] Keep pushing myself at the same pace in spite of the tiredness

40. When you are in a group, how often do the other people look to you for leadership?
    A. [ ] Rarely
    B. [ ] About as often as they look to others
    C. [ ] More often than they look to others

41. How often do you make yourself written lists to help you remember what needs to be done?
    A. [ ] Never
    B. [ ] Occasionally
    C. [ ] Frequently

For questions 42 - 46, compared yourself with the average person in your present designation/classification, and mark the most accurate description.

42. In amount of effort put forth, I give
    A. [ ] much more effort
    B. [ ] a little more effort
    C. [ ] a little less effort
    D. [ ] much less effort

43. In sense of responsibility, I am
    A. [ ] much more responsible
    B. [ ] a little more responsible
    C. [ ] a little less responsible
    D. [ ] much less responsible

44. I find it necessary to hurry
    A. [ ] much more of the time
    B. [ ] a little more of the time
    C. [ ] a little less of the time
    D. [ ] much less of the time

45. In being precise (careful about detail), I am

A. [ ] much more precise
B. [ ] a little more precise
C. [ ] a little less precise
D. [ ] much less precise

46. I approach life in general

A. [ ] much more seriously
B. [ ] a little more seriously
C. [ ] a little less seriously
D. [ ] much less seriously

For questions 47 - 49, compare your present work with your work setting of five years ago. If you have not been working for five years, compare your present job with your first job.

47. I worked more hours per week

A. [ ] at my present job
B. [ ] five years ago
C. [ ] cannot decide

48. I carried more responsibility

A. [ ] at my present job
B. [ ] five years ago
C. [ ] cannot decide

49. I was considered to be at a higher level (in prestige or social position)

A. [ ] at my present job
B. [ ] five years ago
C. [ ] cannot decide

50. How many different job titles have you held in the last ten years? (Be sure to count shifts in kinds of work, shifts to new employers, and shifts up and down within a firm).

A. [ ] 0 - 1
B. [ ] 2
C. [ ] 3
D. [ ] 4
E. [ ] 5 or more

51. How much schooling did you receive?

A. [ ] 0 - 4 years
B. [ ] 5 - 8 years
C. [ ] Some high school
D. [ ] Completed high school
E. [ ] Trade school or business college
F. [ ] Some tertiary education
G. [ ] Degree from university/CAE
H. [ ] Post-graduate work at a college or university

52. When you were in school, were you an officer of any group, such as a student council, school clubs and societies, or captain of an athletic team?

A. [ ] No
B. [ ] Yes, I held one such position
C. [ ] Yes, I held two or more such positions

A.2 Studies 1 and 4

Digit Symbol Substitution Task - Training Sheet

1	2	3	4	5	6	7	8	9
—	⊥	⊐	└	⊔	○	∧	×	=

5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3	6	2	5	1	9	2	8

A.3 **Study 1**

Digit Symbol Substitution Task - Test Sheet

RHYME	TOKEN	INPUT	HONEY	BRAND	WOUND	GLAND	OPERA	APRON
1	2	3	4	5	6	7	8	9
—	⊥	⊐	└	⊔	○	∧	✕	=
CHILD	JUDGE	GRAVE	VODKA	MAKER	QUERY	FLAKE	PILOT	PANIC

2	1	3	2	1	4	2	3	5	2	3	1	4	5	6	3	1	4	1	5	4	2	7	6	3

5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3	6	2	5	1	9	2	8

3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7	9	2	8	1	7	9	4

6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6	5	1	4	9	2	3	8

4	2	7	6	3	2	8	1	9	5	4	7	3	2	6	1	5	4	6	3	7	9	4	8	6

2	3	5	2	3	1	4	6	2	5	9	7	1	8	5	2	9	4	8	6	5	6	3	1	4

7	2	4	8	6	3	7	2	8	1	9	5	1	3	2	1	4	6	5	9	4	8	3	7	6

2	8	5	4	6	3	7	6	2	5	1	8	4	7	3	9	2	8	1	5	7	2	8	5	1

A.4 **Study 1**

State Anxiety Inventory (Spielberger et al., 1970)

(Baseline version)

Self Evaluation Questionnaire

Directions: A number of statements which people have used to described themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel right now, that is, at this moment. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately so	Very much so
1. I feel calm	1	2	3	4 [*]
2. I feel secure	1	2	3	4 [*]
3. I am tense	1	2	3	4
4. I am regretful	1	2	3	4
5. I feel at ease	1	2	3	4 [*]
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel rested	1	2	3	4 [*]
9. I feel anxious	1	2	3	4
10. I feel comfortable	1	2	3	4 [*]
11. I feel self-confident	1	2	3	4 [*]
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel "highly strung"	1	2	3	4
15. I am relaxed	1	2	3	5 [*]
16. I feel content	1	2	3	4 [*]
17. I feel worried	1	2	3	4
18. I feel over-excited and "rattled"	1	2	3	4
19. I feel joyful	1	2	3	4 [*]
20. I feel pleasant	1	2	3	4 [*]

[*] Denotes that reverse scoring is necessary.

A.5 **Study 1**

State Anxiety Inventory

(Post-task version - Two-Minute Condition)

Self Evaluation Questionnaire

Directions: A number of statements which people have used to described themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you felt while doing the intelligence test. Do not spend too much time on any one statement but give the answer which best seems to describe your feelings then.

	Not at all	Somewhat	Moderately so	Very much so
1. I felt calm	1	2	3	4 [*]
2. I felt secure	1	2	3	4 [*]
3. I was tense	1	2	3	4
4. I was regretful	1	2	3	4
5. I felt at ease	1	2	3	4 [*]
6. I felt upset	1	2	3	4
7. I was worrying over possible misfortunes	1	2	3	4
8. I felt rested	1	2	3	4 [*]
9. I felt anxious	1	2	3	4
10. I felt comfortable	1	2	3	4 [*]
11. I felt self-confident	1	2	3	4 [*]
12. I felt nervous	1	2	3	4
13. I was jittery	1	2	3	4
14. I felt "highly strung"	1	2	3	4
15. I was relaxed	1	2	3	5 [*]
16. I felt content	1	2	3	4 [*]
17. I felt worried	1	2	3	4
18. I felt over-excited and "rattled"	1	2	3	4
19. I felt joyful	1	2	3	4 [*]
20. I felt pleasant	1	2	3	4 [*]

[*] Denotes that reverse scoring is necessary.

A.6 Study 1

State Anxiety Inventory

(Post-task version - Four-Minute Condition)

Self Evaluation Questionnaire

Directions: A number of statements which people have used to described themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you felt while doing the first part of the intelligence test. Do not spend too much time on any one statement but give the answer which best seems to describe your feelings then.

	Not at all	Somewhat	Moderately so	Very much so
1. I felt calm	1	2	3	4 [*]
2. I felt secure	1	2	3	4 [*]
3. I was tense	1	2	3	4
4. I was regretful	1	2	3	4
5. I felt at ease	1	2	3	4 [*]
6. I felt upset	1	2	3	4
7. I was worrying over possible misfortunes	1	2	3	4
8. I felt rested	1	2	3	4 [*]
9. I felt anxious	1	2	3	4
10. I felt comfortable	1	2	3	4 [*]
11. I felt self-confident	1	2	3	4 [*]
12. I felt nervous	1	2	3	4
13. I was jittery	1	2	3	4
14. I felt "highly strung"	1	2	3	4
15. I was relaxed	1	2	3	5 [*]
16. I felt content	1	2	3	4 [*]
17. I felt worried	1	2	3	4
18. I felt over-excited and "rattled"	1	2	3	4
19. I felt joyful	1	2	3	4 [*]
20. I felt pleasant	1	2	3	4 [*]

[*] Denotes that reverse scoring is necessary.

A.7 <u>**Study 1**</u>

Scale for rating of self-perceived present health status

Directions: Please describe your physical health at this moment.

Poor						Good
1	2	3	4	5	6	7

A.8 **Study 1**

Symptom Checklist

(Post-task version - Two Minute Condition)

Directions: Please indicate the extent to which you experienced each of the following symptoms during the intelligence test.

No Racing Heart						Severe Racing Heart
1	2	3	4	5	6	7

No Stiff/ Sore Muscles						Severe Stiff/ Sore Muscles
1	2	3	4	5	6	7

No Shortness of Breath						Severe Shortness of Breath
1	2	3	4	5	6	7

No Flushed Face						Severe Flushed Face
1	2	3	4	5	6	7

No Upset Stomach						Severe Upset Stomach
1	2	3	4	5	6	7

No Congested Nose						Severe Congested Nose
1	2	3	4	5	6	7

No Sweaty Hands						Severe Sweaty Hands
1	2	3	4	5	6	7

No Watery Eyes						Severe Watery Eyes
1	2	3	4	5	6	7

No Chest Pains						Severe Chest Pains
1	2	3	4	5	6	7

No Dizziness						Severe Dizziness
1	2	3	4	5	6	7

No Itch						Severe Itch
1	2	3	4	5	6	7

No Ringing Ears						Severe Ringing Ears
1	2	3	4	5	6	7

No Cold Hands						Severe Cold Hands
1	2	3	4	5	6	7

No Headache						Severe Headache
1	2	3	4	5	6	7

A.9 <u>Study 1</u>

Symptom Checklist

(Post-task version - Four-Minute Condition)

Directions: Please indicate the extent to which you experienced each of the following symptoms <u>during</u> the first part of the intelligence test.

No Racing Heart — **Severe Racing Heart**

1	2	3	4	5	6	7

No Stiff/ Sore Muscles — **Severe Stiff/ Sore Muscles**

1	2	3	4	5	6	7

No Shortness of Breath — **Severe Shortness of Breath**

1	2	3	4	5	6	7

No Flushed Face — **Severe Flushed Face**

1	2	3	4	5	6	7

No Upset Stomach — **Severe Upset Stomach**

1	2	3	4	5	6	7

No Congested Nose — **Severe Congested Nose**

1	2	3	4	5	6	7

No Sweaty Hands						Severe Sweaty Hands
1	2	3	4	5	6	7

No Watery Eyes						Severe Watery Eyes
1	2	3	4	5	6	7

No Chest Pains						Severe Chest Pains
1	2	3	4	5	6	7

No Dizziness						Severe Dizziness
1	2	3	4	5	6	7

No Itch						Severe Itch
1	2	3	4	5	6	7

No Ringing Ears						Severe Ringing Ears
1	2	3	4	5	6	7

No Cold Hands						Severe Cold Hands
1	2	3	4	5	6	7

No Headache						Severe Headache
1	2	3	4	5	6	7

A.10 **Study 1**

List of task-peripheral words presented in the Digit Symbol Substitution Test Sheet and in the post-task recognition test and familiarity ratings from Gilhooly and Hay (1977)

Words	Familiarity Ratings
FLAKE [*]	3.97
TULIP	3.17
PILOT [*]	3.60
CABIN	3.30
BUYER	4.07
INPUT [*]	3.65
QUERY [*]	3.82
LOGIC	4.52
VIRUS	3.40
CHILD [*]	4.07
MINCE	4.50
HONEY [*]	4.00
ALBUM	4.60
BANJO	3.17
OPERA [*]	3.52
GLAND [*]	3.77
CABLE	3.40
WOUND [*]	3.85
STYLE	4.88
PANIC [*]	4.40
BRICK	4.82
BRAND [*]	4.10
TRUCK	4.55
INDEX	4.65
JUDGE [*]	4.47
JOINT	4.45
MAKER [*]	3.97
APRON [*]	3.60
TOKEN [*]	3.85
PRUNE	3.05
VODKA [*]	4.47

CLOAK	3.17
GRAVE [*]	4.25
LOVER	4.85
RHYME [*]	4.02
WALTZ	3.15

Note: Familiarity ratings were obtained by Gilhooly and Hay (1977) using a 7-point scale (1 = "never seen,heard, or used", 7 = "seen, heard, or used every day"). Only words with familiarity ratings between 3 and 5 were selected for inclusion in Study One. [*] denotes words presented in the Digit Symbol Substitution Test Sheet.

A.11 Study 1

Task-peripheral word recognition list and ratings of confidence (about having correctly recognized a word)

Directions: The sheet on which you were doing the intelligence test contained a number of words, located just above and below each digit-symbol pair. Please read the list of words presented below and use the 'Yes' column to indicate which words you remember from the test sheet. For each of those words that you remember seeing on the test sheet, please indicate how sure or confident your are about the accuracy of your selection, by using the scale to the right of each word.

	Yes	Very Sure	Sure	Neither Sure/Unsure	Unsure	Very Unsure
FLAKE	[ ]	1	2	3	4	5
TULIP	[ ]	1	2	3	4	5
PILOT	[ ]	1	2	3	4	5
CABIN	[ ]	1	2	3	4	5
BUYER	[ ]	1	2	3	4	5
INPUT	[ ]	1	2	3	4	5
QUERY	[ ]	1	2	3	4	5
LOGIC	[ ]	1	2	3	4	5
VIRUS	[ ]	1	2	3	4	5
CHILD	[ ]	1	2	3	4	5
MINCE	[ ]	1	2	3	4	5
HONEY	[ ]	1	2	3	4	5
ALBUM	[ ]	1	2	3	4	5
BANJO	[ ]	1	2	3	4	5
OPERA	[ ]	1	2	3	4	5
GLAND	[ ]	1	2	3	4	5
CABLE	[ ]	1	2	3	4	5
WOUND	[ ]	1	2	3	4	5
STYLE	[ ]	1	2	3	4	5
PANIC	[ ]	1	2	3	4	5
BRICK	[ ]	1	2	3	4	5
BRAND	[ ]	1	2	3	4	5
TRUCK	[ ]	1	2	3	4	5

	Yes	Very Sure	Sure	Neither Sure/Unsure	Unsure	Very Unsure
INDEX	[ ]	1	2	3	4	5
JUDGE	[ ]	1	2	3	4	5
JOINT	[ ]	1	2	3	4	5
MAKER	[ ]	1	2	3	4	5
APRON	[ ]	1	2	3	4	5
TOKEN	[ ]	1	2	3	4	5
PRUNE	[ ]	1	2	3	4	5
VODKA	[ ]	1	2	3	4	5
CLOAK	[ ]	1	2	3	4	5
GRAVE	[ ]	1	2	3	4	5
LOVER	[ ]	1	2	3	4	5
RHYME	[ ]	1	2	3	4	5
WALTZ	[ ]	1	2	3	4	5

A.12 <u>**Study 1**</u>

Digit Symbol (task-relevant stimuli) Recall Sheet

1	2	3	4	5	6	7	8	9

A.13 **Study 1**

Analysis of variance table for heart rate recorded during baseline - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	13.63	0.10	.901
Types	1	26.04	0.20	.657
Conditions	1	1.23	0.01	.923
2-way Interaction	1	0.01	0.00	.992
Types by Conditions	1	0.01	0.00	.992
Explained	3	9.09	0.07	.976
Residual	40	130.12		
Total	43	121.68		

A.14 **Study 1**

Analysis of variance table for systolic blood pressure recorded during baseline - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	52.20	0.28	.756
Types	1	14.20	0.07	.783
Conditions	1	90.20	0.49	.490
2-way Interaction	1	241.11	1.30	.261
Types by Conditions	1	241.11	1.30	.261
Explained	3	115.17	0.62	.606
Residual	40	185.53		
Total	43	180.62		

A.15 Study 1

Analysis of variance table for diastolic blood pressure recorded during baseline - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	108.57	0.93	.405
Types	1	96.02	0.82	.371
Conditions				
2-way Interaction	1	114.57	0.98	.329
Types by Conditions	1	114.57	0.98	.329
Explained	3	110.57	0.94	.429
Residual	40	117.29		
Total	43	116.82		

A.16 Study 1

Analysis of covariance table for heart rate recorded during the task period - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - with baseline heart rate as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	7044.26	159.97	.000
Baseline Heart Rate	1	7044.26	159.97	.000
Main Effects	2	119.78	2.72	.078
Types	1	236.92	5.38	.026
Conditions	1	2.58	0.06	.810
2-way Interaction	1	21.18	0.48	.492
Types by Conditions	1	21.18	0.48	.492
Explained	4	1826.25	41.47	.000
Residual	39	44.03		
Total	43	209.82		

A.17 **Study 1**

Analysis of covariance table for systolic blood pressure (SBP) recorded during the task period - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - with baseline SBP as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	4664.41	85.61	.000
Baseline SBP	1	4664.41	85.61	.000
Main Effects	2	108.58	1.99	.150
Types	1	217.06	3.98	.053
Conditions	1	0.16	0.00	.957
2-way Interaction	1	128.38	2.36	.133
Types by Conditions	1	128.38	2.36	.133
Explained	4	1252.49	22.99	.000
Residual	39	54.49		
Total	43	165.93		

A.18 **Study 1**

Analysis of covariance table for diastolic blood pressure (DBP) recorded during the task period - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - with baseline DBP as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	3605.74	176.53	.000
Baseline DBP	1	3605.74	176.53	.000
Main Effects	2	4.64	0.28	.798
Types	1	0.74	0.04	.850
Conditions	1	8.43	0.41	.524
2-way Interaction	1	47.53	2.33	.135
Types by Conditions	1	47.53	2.33	.135
Explained	4	915.64	44.83	.000
Residual	39	20.43		
Total	43	103.70		

A.19 **Study 1**

Analysis of variance table for self perceived health status - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - Baseline measure

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	0.11	0.20	.817
Types	1	0.21	0.37	.549
Conditions	1	0.02	0.04	.841
2-way Interaction	1	0.21	0.37	.549
Types by Conditions	1	0.21	0.37	.549
Explained	3	0.14	0.26	.856
Residual	40	0.56		
Total	43	0.53		

A.20 **Study 1**

Analysis of covariance table for total symptom report - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - with self perceived health status as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	276.47	50.37	.000
Health Status	1	276.47	50.37	.000
Main Effects	2	23.22	4.23	.022
Types	1	45.48	8.29	.006
Conditions	1	0.92	0.17	.685
2-way Interaction	1	0.20	0.04	.850
Types by Conditions	1	0.20	0.04	.850
Explained	4	80.78	14.72	.000
Residual	39	5.49		
Total	43	12.49		

A.21 **Study 1**

Analysis of covariance table for self-reported heart racing symptom - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - with self perceived health status as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	7.89	15.61	.000
Health Status	1	7.89	15.61	.000
Main Effects	2	1.79	3.54	.039
Types	1	3.43	6.78	.013
Conditions	1	0.14	0.29	.591
2-way Interaction	1	0.00	0.00	.943
Types by Conditions	1	0.00	0.00	.943
Explained	4	2.87	5.67	.001
Residual	39	0.50		
Total	43	0.72		

A.22 **Study 1**

Analysis of covariance table for self-reported flushed face symptom - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - with self perceived health status as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	3.27	7.16	.011
Health Status	1	3.27	7.16	.011
Main Effects	2	0.90	1.97	.152
Types	1	1.80	3.94	.054
Conditions	1	0.00	0.01	.938
2-way Interaction	1	0.02	0.04	.834
Types by Conditions	1	0.02	0.04	.834
Explained	4	1.27	2.79	.039
Residual	39	0.46		
Total	43	0.53		

A.23 Study 1

Analysis of covariance table for self-reported sweaty hands symptom - 2 (Types: A/B) x 2 (Expected Task Duration Conditions: Two/Four-Minute) - with self-perceived health status as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	13.75	23.51	.000
Health Status	1	13.75	23.51	.000
Main Effects	2	2.00	3.42	.043
Types	1	3.67	6.28	.016
Conditions	1	0.32	0.54	.465
2-way Interaction	1	0.24	0.41	.527
Types by Conditions	1	0.24	0.41	.527
Explained	4	4.50	7.69	.000
Residual	39	0.58		
Total	43	0.95		

A.24 Study 1

Analysis of variance table for self-reported state anxiety during baseline - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	3.86	0.11	.893
Types	1	4.46	0.13	.720
Conditions	1	3.27	0.10	.758
2-way Interaction	1	0.09	0.00	.959
Types by Conditions	1	0.09	0.00	.959
Explained	3	2.61	0.08	.972
Residual	40	34.07		
Total	43	31.88		

A.25 Study 1

Analysis of covariance table for self-reported state anxiety during task performance - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute) - with baseline state anxiety as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	1088.76	90.37	.000
Baseline State Anxiety	1	1088.76	90.37	.000
Main Effects	2	21.91	1.82	.176
Types	1	0.01	0.00	.973
Conditions	1	4.59	0.38	.541
2-way Interaction	1	0.01	0.00	.973
Types by Conditions	1	0.01	0.00	.973
Explained	4	283.15	23.50	.000
Residual	39	12.05		
Total	43	37.27		

A.26 Study 1

Analysis of variance table for (task-relevant) digit symbols correctly recalled - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	0.66	0.25	.780
Types	1	1.11	0.42	.519
Conditions	1	0.20	0.08	.782
2-way Interaction	1	0.02	0.01	.926
Types by Conditions	1	0.02	0.01	.926
Explained	3	0.45	0.17	.916
Residual	40	2.64		
Total	43	2.48		

A.27 <u>Study 1</u>

Analysis of variance table for task-peripheral words correctly recognized - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
<u>Main Effects</u>	2	0.57	0.14	.873
Types	1	0.02	0.00	.942
Conditions	1	1.11	0.27	.609
<u>2-way Interaction</u>	1	0.20	0.05	.826
Types by Conditions	1	0.20	0.05	.826
Explained	3	0.45	0.11	.956
Residual	40	4.19		
Total	43	3.92		

A.28 <u>Study 1</u>

Analysis of variance table for performance in the Digit Symbol Substitution test - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
<u>Main Effects</u>	2	235.11	1.44	.249
Types	1	31.11	0.19	.665
Conditions	1	439.11	2.69	.109
<u>2-way Interaction</u>	1	5.11	0.03	.860
Types by Conditions	1	5.11	0.03	.860
Explained	3	158.45	0.97	.416
Residual	40	163.39		
Total	43	163.04		

A.29 **Study 1**

Analysis of variance table for ratings of confidence regarding the correct recognition of task-peripheral words - 2 (Types: A/B) x 2 (Conditions: Two/Four-Minute)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	0.80	3.80	.033
Types	1	1.61	7.59	.010
Conditions	1	0.00	0.02	.889
2-way Interaction	1	0.05	0.23	.633
Types by Conditions	1	0.05	0.23	.633
Explained	3	0.55	2.61	.069
Residual	32	0.21		
Total	35	0.24		

APPENDIX B

B.1 Study 2

Analysis of variance table for heart rate recorded during the Baseline, Rest, and Perception periods of the Cardiac Perception Task - 2 (Types: A/B) x 3 (Periods: Baseline/Rest/Perception - repeated measures factor)

Source of Variation	DF	MS	F-value	p-value
Error Term for Types Effect	42	262.58		
Types	1	118.28	0.45	.506
Error Term for Periods Effect and Interaction	84	7.62		
Periods	2	41.17	5.41	.006
Types by Periods	2	1.64	0.22	.806

B.2 Study 2

Analysis of variance table for respiration frequency recorded during the Baseline, Rest, and Perception periods of the Cardiac Perception Task - 2 (Types: A/B) x 3 (Periods: Baseline/Rest/Perception - repeated measures factor)

Source of Variation	DF	MS	F-value	p-value
Error Term for Types Effect	42	16.81		
Types	1	4.90	0.29	.592
Error Term for Periods Effect and Interaction	84	0.39		
Periods	2	1.69	4.28	.017
Types by Periods	2	0.11	0.28	.756

B.3 **Study 2**

Analysis of variance table for systolic blood pressure recorded before and after the Cardiac Perception Task - 2 (Types: A/B) x 2 (Periods: Pre-Task/Post-Task - repeated measures factor)

Source of Variation	DF	MS	F-value	p-value
Error Term for Types Effect	42	225.21		
Types	1	11.64	0.05	.821
Error Term for Periods Effect and Interaction	42	4.46		
Periods	1	28.41	6.37	.016
Types by Periods	1	0.18	0.04	.841

B.4 **Study 2**

Analysis of variance table for diastolic blood pressure recorded before and after the Cardiac Perception Task - 2 (Types: A/B) x 2 (Periods: Pre-Task/Post-Task - repeated measures factor)

Source of Variation	DF	MS	F-value	p-value
Error Term for Types Effect	42	182.75		
Types	1	6.01	0.03	.857
Error Term for Periods Effect and Interaction	42	10.98		
Periods	1	5.01	0.46	.503
Types by Periods	1	27.28	2.48	.122

APPENDIX C

C.1 Study 3

Private and Public Self Consciousness Subscales of the Self Consciousness Scale (taken from Fenigstein et al., 1975)

Directions: Below is a number of statements which people have used to described themselves and/or their behaviours. Read each statement and then encircle the appropriate number to the right of the statement to indicate the extent to which each statement is characteristic of you. Remember, there are no 'right' or 'wrong' answers.

	Extremely Uncharacteristic II				Extremely Characteristic II	
1. I'm always trying to figure myself out	1	2	3	4	5	[*]
2. I'm concerned about my style of doing things	1	2	3	4	5	
3. Generally, I'm not very aware of myself	1	2	3	4	5	[*]
4. I reflect about myself a lot	1	2	3	4	5	[*]
5. I'm concerned about the way I present myself	1	2	3	4	5	
6. I'm often the subject of my own fantasies	1	2	3	4	5	[*]
7. I never scrutinize myself	1	2	3	4	5	[*]
8. I'm self-conscious about the way I look	1	2	3	4	5	
9. I'm generally attentive to my inner feelings	1	2	3	4	5	[*]
10. I usually worry about making a good impression	1	2	3	4	5	
11. I'm constantly examining my motives	1	2	3	4	5	[*]
12. One of the last things I do before I leave my house is to look in the mirror	1	2	3	4	5	
13. I sometimes have the feeling that I'm off somewhere watching myself	1	2	3	4	5	[*]

	Extremely Uncharacteristic II				Extremely Characteristic II	
14. I'm concerned about what other people think of me	1	2	3	4	5	
15. I'm alert to changes in my mood	1	2	3	4	5	[*]
16. I'm usually aware of my appearance	1	2	3	4	5	
17. I'm aware of the way my mind works, when I work through a problem	1	2	3	4	5	[*]

[*] Denotes items from the Private Self Consciousness subscale. Items 3 and 7 require reverse scoring.

C.2 <u>**Study 3**</u>

Private and Public Body Consciousness Subscales of the Body Consciousness Scale (taken from Miller et al., 1981)

Directions: Below is a number of statements which people have used to describe themselves and/or their behaviours. Read each statement and then encircle the appropriate number to the right of the statement to indicate the extent to which each statement is characteristic of you. Remember, there are no 'right' or 'wrong' answers.

	Extremely Uncharacteristic II				Extremely Characteristic II	
1. I'm sensitive to internal bodily tensions	0	1	2	3	4	[*]
2. When with others, I want my hands to be clean and look nice	0	1	2	3	4	
3. I know immediately when my mouth or throat gets dry	0	1	2	3	4	[*]
4. It is important for me that my skin looks nice... for example, has no blemishes	0	1	2	3	4	
5. I can often feel my heart beating	0	1	2	3	4	[*]
6. I'm very aware of my best and worst facial features	0	1	2	3	4	
7. I am quick to sense the hunger contractions of my stomach	0	1	2	3	4	[*]
8. I like to make sure that my hair looks right	0	1	2	3	4	
9. I'm very aware of changes in my body temperature	0	1	2	3	4	[*]
10. I think a lot about my body build	0	1	2	3	4	
11. I'm concerned about my posture	0	1	2	3	4	

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[*] Denotes items from the Private Body Consciousness subscale.

APPENDIX D

D.1 Study 4

Digit Symbol Substitution Test Sheet - Difficult Version

1	2	3	4	5	6	7	8	9
—	⊥	⊐	└	⊔	○	∧	×	═

2	1	3	2	1	4	2	3	5	2	3	1	4	5	6	3	1	4	1	5	4	2	7	6	3

5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3	6	2	5	1	9	2	8

3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7	9	2	8	1	7	9	4

6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6	5	1	4	9	2	3	8

4	2	7	6	3	2	8	1	9	5	4	7	3	2	6	1	5	4	6	3	7	9	4	8	6

2	3	5	2	3	1	4	6	2	5	9	7	1	8	5	2	9	4	8	6	5	6	3	1	4

7	2	4	8	6	3	7	2	8	1	9	5	1	3	2	1	4	6	5	9	4	8	3	7	6

2	8	5	4	6	3	7	6	2	5	1	8	4	7	3	9	2	8	1	5	7	2	8	5	1

D.2 Study 4

Digit Symbol Substitution Test Sheet - Easy Version

1	4	7
—	L	Λ

1	4	1	4	7	1	4	4	7	7	1	1	4	4	1	7	4	1	7	4	7	1	4	7	1

7	4	7	4	7	7	4	4	1	4	7	1	1	4	1	4	1	1	7	1	7	4	1	1	4

4	4	1	7	4	1	4	1	4	7	7	1	7	1	4	4	7	1	4	7	1	4	1	7	7

4	1	7	4	7	1	4	7	1	1	4	1	4	7	1	7	1	1	4	4	1	7	4	4	1

1	1	4	7	7	1	7	1	4	7	1	1	7	4	1	4	1	4	1	7	4	1	7	1	4

7	7	4	7	1	4	4	1	4	1	1	4	7	1	4	7	7	1	1	4	1	4	1	4	4

1	7	4	7	1	7	4	1	1	4	7	1	1	4	4	1	7	4	1	4	4	1	7	7	1

4	1	4	7	1	4	4	7	4	7	1	4	7	1	1	4	4	1	7	4	1	7	4	7	4

D.3 Study 4

Analysis of variance table for reaction time to electrical stimulus presented during baseline - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	0.17	1.69	.197
Types	1	3.23	3.22	.079
Conditions	1	0.01	0.15	.698
2-way Interaction	1	0.14	1.39	.245
Types by Conditions	1	0.14	1.39	.245
Explained	3	0.16	1.59	.206
Residual	44	0.10		
Total	47	0.11		

D.4 Study 4

Analysis of covariance table for reaction time to electrical stimulus presented during the Easy and Difficult periods of primary task performance - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) x 2 (Periods: Easy/Difficult -repeated measures factor) with reaction time during baseline as the covariate

Source of Variation	DF	MS	F-value	p-value
Error Term for Types and Conditions Effects and Interaction	43	0.13		
Types	1	0.44	3.34	.075
Conditions	1	0.06	0.45	.505
Types by Conditions	1	0.00	0.00	.987
Error Term for Periods Effect and Interactions involving Periods	44	0.02		
Periods	1	0.26	11.23	.002
Types by Periods	1	0.04	1.79	.188
Conditions by Periods	1	0.00	0.12	.726
Types by Conditions by Periods	1	0.02	0.97	.330

D.5 <u>Study 4</u>

Analysis of variance table for performance in the Easy and Difficult Versions of the Digit Symbol Substitution Task - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) x 2 (Periods: Easy/Difficult - repeated measures factor)

Source of Variation	DF	MS	F-value	p-value
Error Term for Types and Conditions Effects and Interaction	44	773.19		
Types	1	1327.59	1.72	.197
Conditions	1	1496.26	1.94	.171
Types by Condition	1	184.26	0.24	.628
Error Term for Periods Effect and Interactions involving Periods	44	142.09		
Periods	1	79868.34	562.10	.000
Types by Periods	1	123.76	0.87	.356
Conditions by Periods	1	137.76	0.97	.330
Types by Conditions by Periods	1	276.76	1.95	.170

APPENDIX E

E.1 **Study 5**

Table used for the prediction of maximal oxygen uptake from HR and work load (values should be adjusted for age). Taken from Astrand and Rodahl (1977, p 351)

	Maximal oxygen uptake (litres . min-1)				
	Work load			Work load	
Heart Rate	600 kpm/min or 100 watts	900 kpm/min or 150 watts	Heart Rate	600 kpm/min or 100 watts	900 kpm/min or 150 watts
120	3.5	4.8	146	2.4	3.3
121	3.4	4.7	147	2.4	3.3
122	3.4	4.6	148	2.4	3.2
123	3.4	4.6	149	2.3	3.2
124	3.3	4.5	150	2.3	3.2
125	3.2	4.4	151	2.3	3.1
126	3.2	4.4	152	2.3	3.1
127	3.1	4.3	153	2.2	3.0
128	3.1	4.2	154	2.2	3.0
129	3.0	4.2	155	2.2	3.0
130	3.0	4.1	156	2.2	2.9
131	2.9	4.0	157	2.1	2.9
132	2.9	4.0	158	2.1	2.9
133	2.8	3.9	159	2.1	2.8
134	2.8	3.9	160	2.1	2.8
135	2.8	3.8	161	2.0	2.8
136	2.7	3.8	162	2.0	2.8
137	2.7	3.7	163	2.0	2.8
138	2.7	3.7	164	2.0	2.7
139	2.6	3.6	165	2.0	2.7
140	2.6	3.6	166	1.9	2.7
141	2.6	3.5	167	1.9	2.6
142	2.5	3.5	168	1.9	2.6
143	2.5	3.4	169	1.9	2.6
144	2.5	3.4	170	1.8	2.6
145	2.4	3.4			

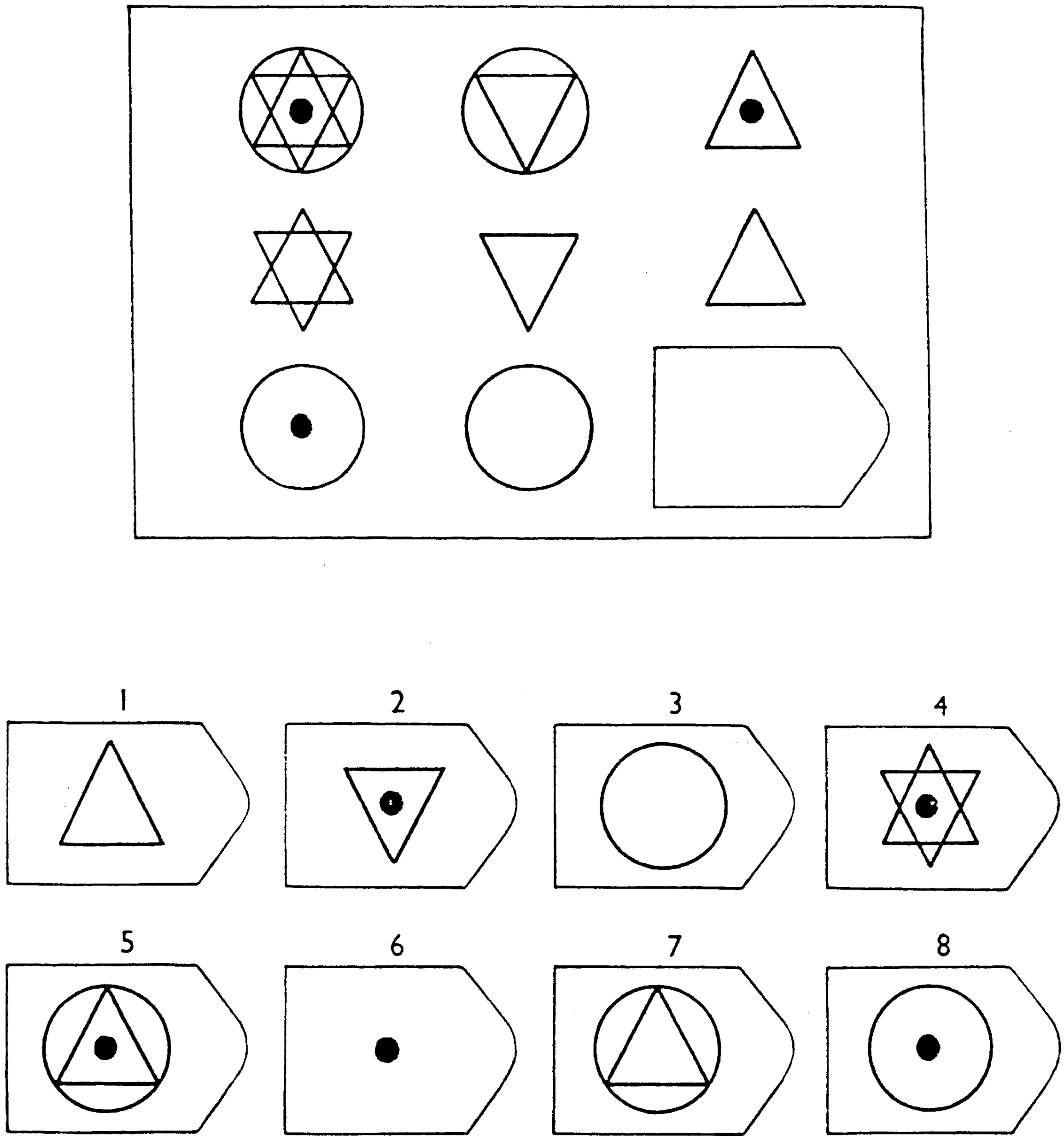
E.2 **Study 5**

Factors used in correcting predicted maximal oxygen uptake for age. Taken from Astrand and Rodahl (1977, p.352)

Age	Age correction factor
15	1.10
25	1.00
35	0.87
40	0.83
45	0.78
50	0.75
55	0.71
60	0.68
65	0.65

E.3 **<u>Study 5</u>**

Sample item from Raven's (1962) Advanced Progressive Matrices Set 2



E.4 **Study 5**

Borg's (1962) Ratings of Perceived Exertion Scale

Directions: Please indicate on the scale below how 'heavy' was the work that you just completed on the bicycle ergometer.

	Very Very Light		Very Light		Fairly Light		Some-what Heavy		Heavy		Very Heavy		Very Very Heavy	
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

E.5 Study 5

Symptom Checklist

Directions: Please indicate the extent to which you experienced each of the following symptoms during the period of physical exercise you just completed.

No Racing Heart						Severe Racing Heart
1	2	3	4	5	6	7

No Stiff/ Sore Muscles						Severe Stiff/ Sore Muscles
1	2	3	4	5	6	7

No Shortness of Breath						Severe Shortness of Breath
1	2	3	4	5	6	7

No Flushed Face						Severe Flushed Face
1	2	3	4	5	6	7

No Upset Stomach						Severe Upset Stomach
1	2	3	4	5	6	7

No Congested Nose						Severe Congested Nose
1	2	3	4	5	6	7

No Sweaty Hands						Severe Sweaty Hands
1	2	3	4	5	6	7

No Watery Eyes						Severe Watery Eyes
1	2	3	4	5	6	7

No Chest Pains						Severe Chest Pains
1	2	3	4	5	6	7

No Dizziness						Severe Dizziness
1	2	3	4	5	6	7

E.6 <u>Study 5</u>

Scales for rating task difficulty and task interest
(High Distraction Condition)

How difficult was the intelligence test you completed while exercising on the bicycle ergometer?

Not Difficult						Difficult
1	2	3	4	5	6	7

How interesting was the intelligence test that you completed while exercising on the bicycle ergometer?

Not Interesting						Interesting
1	2	3	4	5	6	7

E.7 Study 5

Scales for rating task difficulty and task interest

(Moderate Distraction Condition)

How difficult was the matrices task you completed while exercising on the bicycle ergometer?

Not Difficult						Difficult
1	2	3	4	5	6	7

How interesting was the matrices task that you completed while exercising on the bicycle ergometer?

Not Interesting						Interesting
1	2	3	4	5	6	7

E.8 **Study 5**

Scales for rating task difficulty and task interest

(Low Distraction Condition)

How difficult was the light perception task you completed while exercising on the bicycle ergometer?

Not Difficult						Difficult
1	2	3	4	5	6	7

How interesting was the light perception task that you completed while exercising on the bicycle ergometer?

Not Interesting						Interesting
1	2	3	4	5	6	7

E.9 Study 5

Scales for self reported frequency of attention to work load and physical reactions

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While exercising on the bicycle ergometer, how often did you think about the level of physical work that you were doing?

NOT AT ALL						VERY OFTEN
1	2	3	4	5	6	7

While exercising on the bicycle ergometer, how often did you attend to physical reactions to exercise (such as perspiration, pain, heart rate, sore or stiff muscles)?

NOT AT ALL						VERY OFTEN
1	2	3	4	5	6	7

E.10 **Study 5**

Analysis of variance table for total symptom report - 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction)

Source of Variation	DF	MS	F-value	p-value
Main Effects	3	53.94	2.14	.109
Types	1	58.52	2.32	.135
Conditions	2	51.65	2.05	.141
2-way Interaction	2	84.15	3.34	.045
Types by Conditions	2	84.15	3.34	.045
Explained	5	66.02	2.62	.038
Residual	42	25.18		
Total	47	29.52		

E.11 **Study 5**

Analysis of variance table for ratings of work load (on the perceived exertion scale) - 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction)

Source of Variation	DF	MS	F-value	p-value
Main Effects	3	5.44	1.78	.167
Types	1	13.02	4.25	.045
Conditions	2	1.65	0.54	.588
2-way Interaction	2	1.52	0.50	.612
Types by Conditions	2	1.52	0.50	.612
Explained	5	3.87	1.26	.297
Residual	42	3.06		
Total	47	3.15		

E.12 <u>Study 5</u>

Analysis of variance table for self-reported frequency of attention to work load - 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction)

Source of Variation	DF	MS	F-value	p-value
<u>Main Effects</u>	3	2.46	2.01	.128
Types	1	3.52	2.86	.098
Conditions	2	1.94	1.58	.219
<u>2-way Interaction</u>	2	1.40	1.14	.331
Types by Conditions	2	1.40	1.14	.331
Explained	5	2.04	1.66	.166
Residual	42	1.23		
Total	47	1.31		

E.13 <u>Study 5</u>

Analysis of variance table for self-reported frequency of attention to physical reactions - 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction)

Source of Variation	DF	MS	F-value	p-value
<u>Main Effects</u>	3	5.90	3.34	.028
Types	1	2.52	1.43	.239
Conditions	2	7.58	4.30	.020
<u>2-way Interaction</u>	2	1.33	0.75	.476
Types by Conditions	2	1.33	0.75	.476
Explained	5	4.07	2.31	.061
Residual	42	1.76		
Total	47	2.01		

E.14 <u>Study 5</u>

Analysis of variance table for ratings of task difficulty - 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction)

Source of Variation	DF	MS	F-value	p-value
<u>Main Effects</u>	3	22.13	13.80	.000
Types	1	2.52	1.57	.217
Conditions	2	31.94	19.91	.000
<u>2-way Interaction</u>	2	3.52	2.19	.124
Types by Conditions	2	3.52	2.19	.124
Explained	5	14.69	9.16	.000
Residual	42	1.60		
Total	47	3.00		

E.15 <u>Study 5</u>

Analysis of variance table for ratings of task interest - 2 (Types: A/B) x 3 (Conditions: High Distraction/Moderate Distraction/Low Distraction)

Source of Variation	DF	MS	F-value	p-value
<u>Main Effects</u>	3	4.96	1.78	.165
Types	1	4.08	1.47	.232
Conditions	2	5.40	1.94	.156
<u>2-way Interaction</u>	2	0.02	0.01	.993
Types by Conditions	2	0.02	0.01	.993
Explained	5	2.98	1.07	.389
Residual	42	2.78		
Total	47	2.80		

E.16 Study 5

Analysis of variance table for number of matrices attempted by subjects in the High Distraction and Moderate Distraction Conditions - 2 (Types: A/B) x 2 (Conditions: High Distraction/Moderate Distraction)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	45.62	2.32	.117
Types	1	55.12	2.80	.105
Conditions	1	36.12	1.83	.186
2-way Interaction	1	6.12	0.31	.582
Types by Conditions	1	6.12	0.31	.582
Explained	3	32.46	1.65	.201
Residual	28	19.70		
Total	31	20.93		

E.17 Study 5

Analysis of variance table for number of matrices correctly solved by subjects in the High Distraction and Moderate Distraction Conditions - 2 (Types: A/B) x 2 (Conditions: High Distraction/Moderate Distraction)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	26.03	1.92	.165
Types	1	13.78	1.02	.322
Conditions	1	38.28	2.82	.104
2-way Interaction	1	0.03	0.00	.962
Types by Conditions	1	0.03	0.00	.962
Explained	3	17.36	1.28	.300
Residual	28	13.55		
Total	31	13.92		

APPENDIX F

F.1 **Study 6**

Analysis of variance table for Maximal Isometric Voluntary Contraction Capacity - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	297.69	5.67	.007
Types	1	538.31	10.26	.003
Conditions	1	49.68	0.95	.336
2-way Interaction	1	80.80	1.54	.222
Types by Conditions	1	80.80	1.54	.222
Explained	3	225.39	4.29	.010
Residual	41	52.48		
Total	44	64.27		

F.2 **Study 6**

Analysis of variance table for endurance of 30% of Maximal Voluntary Isometric Contraction during the baseline phase - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	4337.32	0.95	.393
Types	1	42.22	0.01	.924
Conditions	1	8602.13	1.89	.176
2-way Interaction	1	797.97	0.18	.677
Types by Conditions	1	797.97	0.18	.677
Explained	3	3157.54	0.69	.560
Residual	41	4541.02		
Total	44	4446.69		

F.3 **Study 6**

Analysis of covariance table for endurance of 30% of Maximal Voluntary Isometric Contraction during the study phase - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) with baseline endurance as the covariate

Source of Variation	DF	MS	F-value	p-value
Covariate	1	20587.70	2.09	.156
Baseline Endurance	1	20589.70	2.09	.156
Main Effects	2	70077.35	7.11	.002
Types	1	58927.58	5.98	.019
Conditions	1	83724.22	8.50	.006
2-way Interaction	1	38976.30	3.95	.054
Types by Conditions	1	38976.30	3.95	.054
Explained	4	49929.67	5.07	.002
Residual	40	9854.70		
Total	44	13497.88		

F.4 **Study 6**

Analysis of variance table for number of cognitive task items (i.e., regression by seven) attempted by subjects - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	1679.20	0.76	.476
Types	1	2741.81	1.23	.273
Conditions	1	674.12	0.30	.585
2-way Interaction	1	3040.24	1.37	.249
Types by Conditions	1	3040.24	1.37	.249
Explained	3	2132.88	0.96	.421
Residual	41	222.77		
Total	44	2215.71		

F.5 Study 6

Analysis of variance table for number of cognitive task items (i.e, regression by seven) correctly solved by subjects - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	1653.78	0.73	.488
Types	1	2782.70	1.23	.274
Conditions	1	578.45	0.25	.616
2-way Interaction	1	3082.39	1.36	.250
Types by Conditions	1	3082.39	1.36	.250
Explained	3	2129.98	0.94	.430
Residual	41	2267.33		
Total	44	2257.96		

F.6 Study 6

Analysis of variance table for response rate in the cognitive task (i.e., regression by seven) - 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge)

Source of Variation	DF	MS	F-value	p-value
Main Effects	2	0.77	0.22	.803
Types	1	0.25	0.07	.789
Conditions	1	1.27	0.36	.551
2-way Interaction	1	0.00	0.00	.997
Types by Conditions	1	0.00	0.00	.997
Explained	3	0.52	0.15	.931
Residual	41	3.51		
Total	44	3.30		

Addendum

It has been brought to my attention that the following points require clarification:

1. Inconsistencies in the literature concerning the association between Type A behaviour and symptom under-report

It is acknowledged that the research reported in the literature concerning the possible association between Type A classification and symptom under-report has to some extent yielded inconsistent findings. Evaluation of the entire body of literature indicates that these inconsistencies may be due to the utilization of different subject populations, measures of Type A behaviour, experimental and survey methods of data collection, and definitions of what constitutes symptom report or awareness. In general, however, those studies in which Type A and Type B subjects had been required to report actual symptoms given rise by experimental procedures, have yielded a consistent observation of an association between Type A classification and symptom under-report. The research reported in this thesis was concerned with the replication of this finding in a population of employed adult males, and the elucidation of the factors which may underlie this phenomenon. As such, the discussion of the literature in Chapter 3 (Section 3.1.1) was restricted to experimental studies using measures of actual symptom report or regulation of behavioural output based on symptom detection and field studies in which care was taken to identify a period of stress or activity for which symptom report was required from subjects.

The fact that some survey studies have failed to observe an association between Type A classification and symptom under-report appears to be related to their failure to identify a reference period for symptom report and thus compare Type A and Type B subjects' report without reference to actual physiological arousal (or other internal changes) or reference to the distraction from symptom awareness available in the environment at the time in which arousal was available for processing.

The experimental study by Essau and Jamiesson (1987), which measured Type A and Type B individuals' estimation of heart rate, evaluated a phenomenon which is practically and conceptually different to that evaluated by studies in which actual symptom report or regulatory actions based on symptom detection are the dependent variables. The reason for this is that heart rate estimation may simply reflect subjects' prior knowledge of resting heart rate and thus may not be based on subjects' actual detection of visceral stimuli. Furthermore, even if one was to accept that the heart rate estimation procedure may evaluate actual processing differences, it is not clear whether heart rate estimation reflects the same cognitive processes as the report of actual symptomatology. The observation that Type A individuals may overestimate heart rate relative to Type Bs (see Essau and Jamiesson, 1987) is not inconsistent with the finding yielded by studies reported in this thesis, that under certain circumstances Type A individuals may exhibit restricted processing of visceral stimuli and thus be inaccurate in reporting these stimuli.

Finally, it should be noted that the heart beat detection task reported in Chapter 1 (Study 2) was conceptualized as a measure of dispositional visceral perceptiveness and not as a measure of symptom report. As would be recalled, the rationale behind this task was that individual differences in visceral perceptiveness may account for differences in symptom report. The detection of individual heart beats involves different processes to those involved in heart rate estimation in that the former cannot be 'guessed' from knowledge of resting heart rate or does not involve inferences made from the combined perception of the passage of time and the frequency of heart beat occurrence. Individual heart beats may be perceived directly (see Blascovich and Katkin, 1983). Thus, heart beat detection may be said to be a fundamental cardiac perception process, measurement of which serves to evaluate dispositional visceral perceptiveness.

2. Correction for small subject numbers in Chi-square analyses in Chapter 6 (Study 4)

It should be noted that all Chi-squares reported in Chapter 6 (pp. 153 - 156) in relation to Study 4 have been corrected for small numbers using the Yates Correction procedure available in SPSS^{X} (SPSS Inc., 1983).

3. Experimental design leading to the statistical analysis of data in Tables 8.3 and 8.4 (Chapter 8 - Section 8.1.5.2)

The design and experimental arrangements leading to the statistical analysis of the data presented in Tables 8.3 and 8.4 were discussed in detail in Sections 8.1.4.4.1 to 8.1.4.4.3 and were summarized in section 8.1.4.4.4.

Furthermore, the statistical analyses of the data presented in Tables 8.3 and 8.4 were discussed in Section 8.1.5.2 adjacent to the relevant tables.

In order to further clarify the design of Study 4 and the reasons for the statistical procedures employed, the following comments are now made:

As explained in the body of the thesis, Study 4 consisted of two phases, baseline and study phases. During both phases subjects were required to maintain voluntary isometric contraction to fatigue at a tension previously estimated to tax 30% of each subject's individual maximal voluntary isometric contraction capacity. The fact that all subjects were asked to endure isometric contraction at 30% of their individually assessed capacity served to ensure comparable potential subjective experiences of fatigue across subjects.

During the baseline phase subjects were not required to perform any distracting tasks. The duration of isometric contraction to fatigue during the baseline phase was treated as a measure of subjects' ability to endure isometric contraction under 'control' conditions or conditions which did not involve the environmental parameters which the results of previous studies had indicated to be capable of leading Type A individuals to exhibit restricted processing of task-peripheral visceral stimuli.

During the study phase, subjects were required to perform a similar isometric contraction to fatigue (at 30% of maximal voluntary capacity) to that which they had carried out during the baseline phase. However, during isometric contraction in the study phase, subjects were also required to perform a relatively demanding cognitive task. Previous research had indicated that the availability for processing of complex external stimuli had a facilitating effect in the endurance of strenuous activities due to the restricted processing of task-peripheral visceral stimuli necessitated by attention to complex external task-relevant stimuli. There was also some evidence that in response to such need to process relatively complex external stimuli, Type A individuals may exhibit greater restricted processing of task-peripheral stimuli than their Type B counterparts. Thus, the reason for the inclusion of a cognitive task during the study phase.

The study phase isometric contraction was performed under one of two conditions of ego challenge. In the Challenge Condition subjects were instructed that accurate performance of the cognitive task reflected efficiency and other desirable personal attributes, which may induce subjects to perceive the cognitive task as important. The importance of external stimuli had been shown by studies reported in the literature to detrimentally affect the likelihood that task-peripheral visceral stimuli be processed. Furthermore, Studies 4 and 5 of this thesis had indicated that perceived ego challenge or threat may differentially affect the extent to which Type A and Type B individuals may process task-peripheral visceral stimuli. It is important to stress that the subject of the ego challenge was performance in the cognitive task and not endurance of the isometric contraction.

It was reasoned that the introduction of external stimulus complexity and importance during the study phase would permit the evaluation of the extent to which these variables differentially affect the processing of visceral stimuli by Type A and Type B individuals and the extent to which such differential processing may affect the prompt implementation of self-regulatory behaviours.

Although baseline phase contractions were not carried out in conjunction with a cognitive task or challenging instructions, the need to use baseline endurance data as a benchmark from which to judge the effects of external stimulus complexity and importance on endurance during the study phase, necessitated that baseline data presented in Table 8.3 be analyzed in terms of a 2(Types: A/B) x 2(Conditions: Challenge/No Challenge) analysis of variance. As noted in Section 8.1.5.2 (p. 209), this analysis revealed no significant main effects or interactions, which indicates that in the absence of important and complex external stimuli, Type A and Type B individuals do not differ in their processing of visceral stimuli governing the regulation of isometric contraction endurance.

In order to establish whether Type A and Type B subjects' endurance of isometric contraction was differentially affected by the introduction of complex and/or important (ego challenging) external stimuli, endurance data collected during the study phase and presented in Table 8.4 were subjected to a 2 (Types: A/B) x 2 (Conditions: Challenge/No Challenge) analysis of covariance with endurance during baseline contraction as the covariate. Although no significant differences in endurance of isometric contraction during the baseline phase had been observed, it was judged necessary to control through covariance procedures for non significant differences during baseline which may have affected the interpretation of differences during the study phase. As reported in Section 8.1.5.2 (pp. 211-212), the analysis of covariance of the isometric contraction data revealed a significant types effects, which consideration of the means in Table 8.4 proved to be due to the fact that while exposed to complex external stimuli during the study phase Type A subjects (regardless of condition) exhibited a greater increase (from baseline) in endurance of isometric contraction than did Type Bs. The analysis of covariance also revealed a nearly significant types by conditions interaction. A posteriori comparisons between all pairs of types-conditions cell means (adjusted for baseline endurance levels) revealed that this interaction was due to the fact that while exposed to complex external stimuli, Type A subjects in the Challenge Condition exhibited a significantly greater increase (from baseline) in endurance of isometric contraction than their No Challenge Condition counterparts and Type B subjects in general. This interaction was graphically depicted in Figure 8.1. In general then, the results of the analysis of covariance served to support the notion that exposure to complex and important (ego challenging or threatening) external stimuli may cause Type As to exhibit restricted processing of visceral stimuli which is manifested (not only in symptom under-report but also) in their failure to promptly implement self-regulatory steps and thus avoid exerting themselves beyond the point of fatigue which they themselves and others would normally tolerate. The implications of these observations were discussed in greater detail in Chapter 8 (Section 8.1.6).